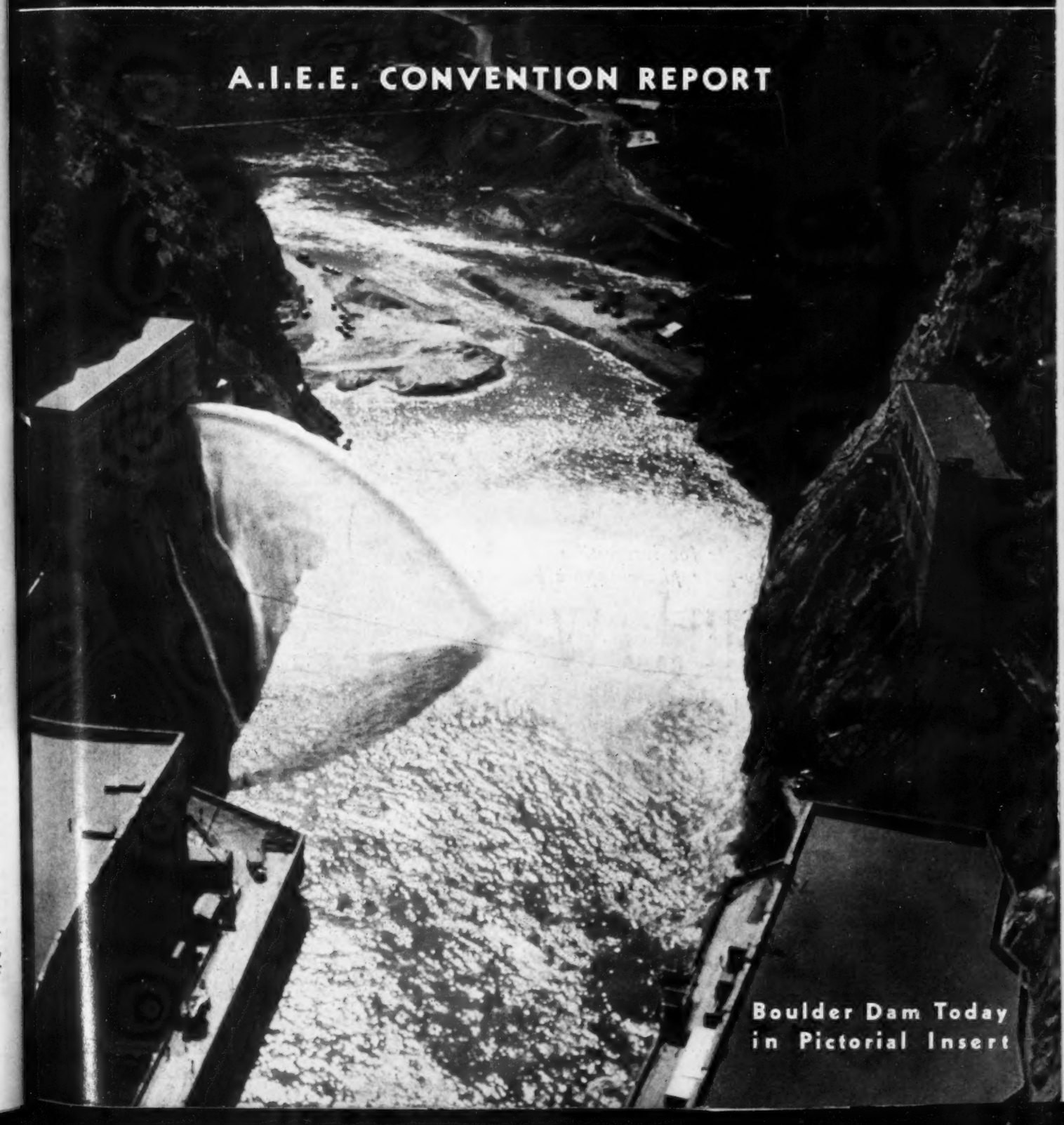
JULY 18, 1936

ELECTRICAL WORLD

cGRAW-HILL PUBLISHING COMPANY, INC., NEW YORK CITY. 25 CENTS PER COPY

UNIV OF MICHIGAN
GENERAL LIBRARY
ANN ARBOR MICH

A.I.E.E. CONVENTION REPORT



Boulder Dam Today in Pictorial Insert

NEW IMPROVEMENTS

making this crowsnest even more outstanding

Speed adaptability—dependability and long life — economy of operation — these are major reasons why the Murray Crowsnest is preferred by many leading utility companies.

New improvements, making it even more outstanding for safety and service, include: steel base plate, airplane Sitka spruce uprights, hickory rungs, longer run ferrules, new type front riding support, longer pivot yoke.

One man can speedily operate the Murray Crowsnest—set it up and swing through a full 360° in any angle of the ten different degrees of inclination.

The Murray Crowsnest is the ladder-rig widely accepted for lamp servicing, line work, tree trimming, painting of standards, wire inspection.

Write for interesting 16-page photographic booklet.

MURRAY DEMOUNTABLE CROWSNEST

METROPOLITAN DEVICE CORP'N
1250 ATLANTIC AVENUE,
BROOKLYN, N. Y.

Please send, without obligation, 16-page booklet, showing Crowsnest in action.

Name ..... Title .....

Company ..... Address .....

ELECTRICAL WORLD

FOUNDED IN 1874 ✦ ✦ READ BY ELECTRICAL MEN FOR SIXTY YEARS

HOWARD EHRLICH, Vice-President

L. W. W. MORROW
Editor

W. K. BEARD, Jr.
Manager

A. E. KNOWLTON, Associate Editor
EARL WHITEHORNE, Associate Editor
H. G. DOOLEY, Associate Editor
G. F. WITTIG, Statistical Editor
FRANK R. INNES, Western Editor
H. S. KNOWLTON, New England Editor
PAUL WOOTON, Washington Correspondent
L. H. CHURCH, Cleveland Editor
C. W. LEIHY, Pacific Coast Editor

Reader's Guide to This Issue

Major emphasis in this issue is on the A.I.E.E. discussions at Pasadena and on what those who went to Boulder Dam saw. There are hydro articles from the Midwest and far West. There is electric heating information from Mason City, Wash. Professor Jackson leaps from the West Coast to Japan with his report on the electrical status. Veritably, the Western flavor monopolizes this timely issue.

Of Executive Interest

Boulder Dam in Pictures—The A.I.E.E. Convention—Prof. Jackson on Electrical Japan—Mason City Electric Heating.

For Power Company Engineers

Discussions at A.I.E.E. Sessions—Hydraulic Loss Tests—Waterwheel Generator Design—Experience with Electric Heating

On Power Company Sales

Data on Brewery Applications—Heating Results in Mason City—Agricultural Load Opportunity—Pumps for Lobster Pound

For Electrical Engineers

Discussion at A.I.E.E. Convention — Waterwheel Generator Design—Hydraulic Loss Tests—Photocell Measures Motor Slip

For Electrical Manufacturers

Report on Industry in Japan—Boulder Dam in Pictures—A.I.E.E. Convention Report—"Electric City" Heating Data

CONTENTS

JULY 18, 1936

A.I.E.E. Meets on West Coast 29
Extended presentation of the happenings and the discussion at the week's sessions.

Heating an All-Electric City 35
Specific data on consumption in the "city without a chimney."

Design for Waterwheel Generator . . 36
S. H. Mortensen gives details of the design for the Allis-Chalmers machine at Boulder Dam.

Advertising Purchased Power 38
Sample of effective way of doing it.

Electrical Industry in Japan 39
Prof. D. C. Jackson tells what he learned while relating our own practices and philosophy to the Japanese.

Boulder Dam at Present 43
Pictorial treatment of the status of completion stages for electrical installation.

Hydraulic Loss Tests 51
Tunnel and penstock tests throw light on entrance and diversion losses.

Carter Field on Washington Events . 56

Editorials . . . . 27 and 54
News of the Week . . . 58
Operating Practices . . 68
Power at Work 72
Brewery Data Sheets . 75
Engineering Ideas . . . 76
Building the Load . . . 83
Men of the Industry . 86
New Equipment 90
Recent Rate Changes . 94
Municipal Items 96
Sales Opportunities . . 102

Coming Features

World Power Conference

Special articles on steam plants, eight-page map of the national power system, power statistics. To paint true picture of American power practice to visiting foreign engineers.

Special Lighting Issue

Photos and stories on how to sell lighting and results in industrial, commercial highway and domestic lighting will be in ELECTRICAL WORLD on August 1. Better Light-Better Sight, I.E.S. lamps and fall program, what the lighting industry has to offer and how to organize and sell light will be among the subjects discussed.

Rural Construction Practice

A special insert showing equipment and construction on rural lines—pole tops, transformer poles, services, guying, spans, protection, metering, regulation, substations—a grouping on a selective basis of the best rural practices will be in ELECTRICAL WORLD of August 15.

Telemetering

New scheme devised and described by E. E. George is peculiarly appropriate for intercompany ties.

ELECTRICAL WORLD—Published every Saturday. Price 25 cents a copy. Subscription rates: United States, Canada, Mexico, Central and South American countries, $4 a year; all other countries, $6 or 24 shillings a year. Entered as second-class matter, January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

VOLUME 106 . . . NUMBER 29

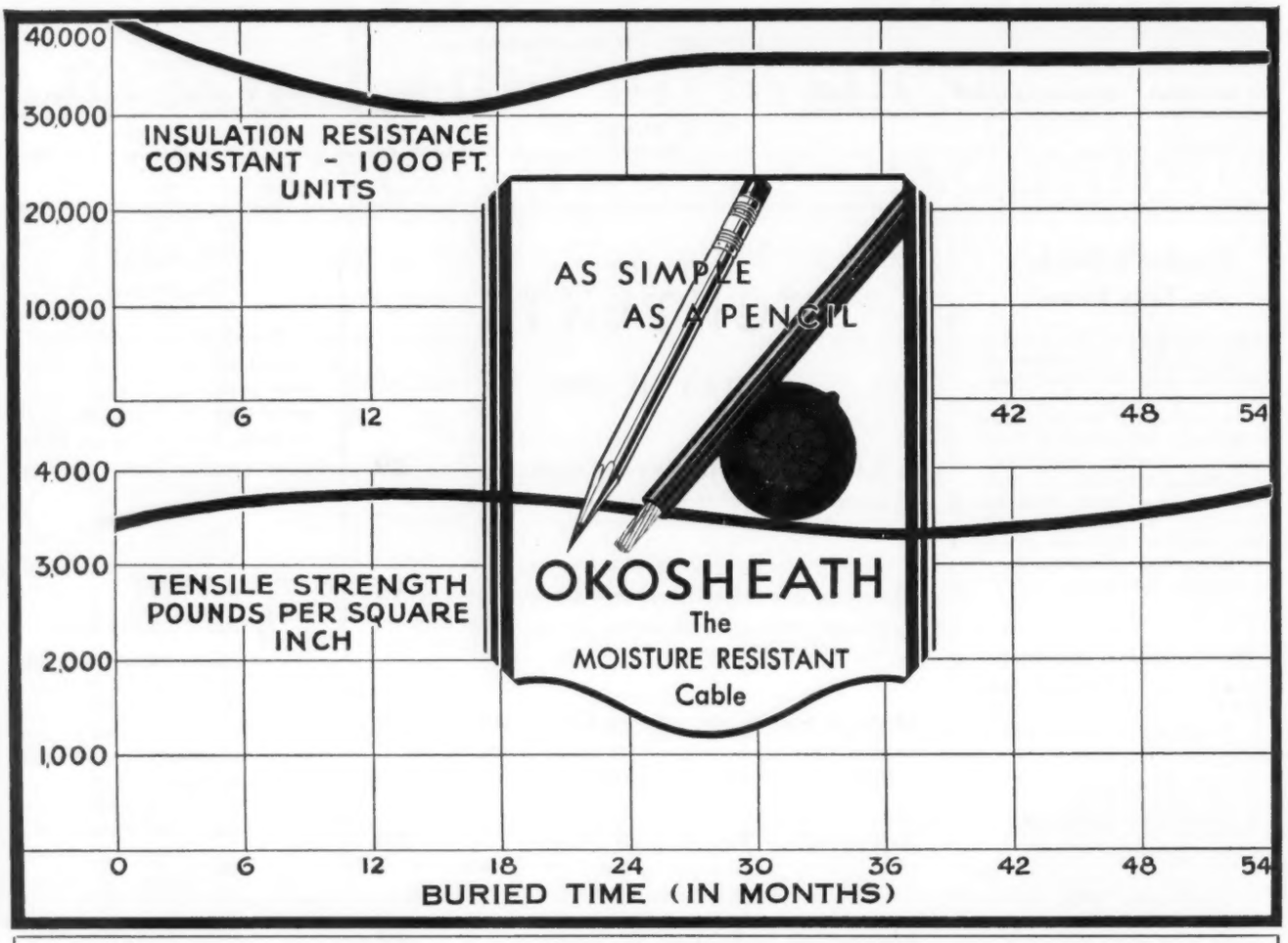
Contents Copyrighted, 1936, by McGraw-Hill Publishing Company, Inc.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 West 42d Street, New York, N. Y.

JAMES H. McGRAW, JR., Chairman
MALCOLM MUIR, President
JAMES H. McGRAW, Honorary Chairman
HOWARD EHRLICH, Vice-President
B. R. PUTNAM, Treasurer
D. C. McGRAW, Secretary

Cable Address: MCGRAWHILL, New York. Member A.B.P. Member A.B.C.

OKOSHEATH A NON-METALLIC SHEATHED CABLE



The excellent moisture resistance of Okosheath cable is shown by the above curves. These show the results obtained on a length of standard, single conductor No. 4/0 A. W. G., 600 volt Okosheath cable which has been buried in *wet ground* for five years. It was removed periodically and tested after twelve hours immersion in water.

Mark the extreme simplicity of Okosheath cable. Just a tough rubber belt around the conductor. That is Okosheath. Simple in design—but it *lasts.*

There is nothing to deteriorate and rot away. Enormous quantities of Okosheath, used both in conduit and buried directly in the ground, have demonstrated its durability. The Okosheath Service Record: *No complaints, no failures.*

Okosheath is effectually moisture resistant. It is clean, smooth, flexible, light in weight, small in diameter; easy to handle and install. A lineman can splice it. Tough and compact, Okosheath is just the cable for the tough pulls.

Okosheath opens the way for the new trends and demands. Besides lower first cost, it saves in maintenance. The dollar benefits are *both* ways.

Note: The above chart appears in our latest booklet on Okosheath, which will be mailed upon request.

THE OKONITE COMPANY
Founded 1878
and
HAZARD INSULATED WIRE WORKS DIVISION

THE OKONITE-CALLENDER CABLE COMPANY, INC.
EXECUTIVE OFFICE: PASSAIC, N. J.

New York	Boston		Chicago	Detroit
Philadelphia	Pittsburgh		Washington	San Francisco
Los Angeles	Seattle		Dallas	Atlanta
Factories: Passaic, N. J.		Wilkes-Barre, Pa.		Paterson, N. J.

OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

ELECTRICAL WORLD

MANAGEMENT • ENGINEERING • OPERATION • UTILIZATION

PUBLISHED EVERY SATURDAY

JULY 18, 1936

•

Engineers—Leaders or Followers?

Electrical engineers are again active and creative. This is evident from the A.I.E.E. meeting in Pasadena as well as by other contacts. They have regained their usual confidence and morale.

During the building and expansion era engineering was dominantly construction and manufacture. It was practice instead of creative development. Now there is a new period at hand. One in which new and better things and methods will force the replacement of the old and offer opportunity for the industry to increase its business.

Recent modernization moves in the steel, automotive, foundry and machine tool industries were forced by the creative work of electrical engineers. Business had to act to meet the new competition.

Equally significant new ideas and developments are found in the light and power business. No one can say how quickly the economic status of our present a.c. system will change or when the individual parts will be rendered obsolete. If the engineers find something better and cheaper the industry will be forced to accept and use the new contributions.

Engineering advances still lie in the base of the business structure. Any threat that comes from making existing things obsolete is more than offset by the opportunities these developments give the industry to expand its business and lower its costs.

Just now utility loads are mounting rapidly. There is going to be a large building program this fall and next year to meet the new demands. It is highly important, therefore, that engineers should be active and creative. *The new investments should be based upon new engineering.*

This calls to mind another function of engineers. They should aid the industry and the public by counsel and advice. They should point the way to executives. They should give the public engineering facts. For example, the engineers know the economics and technical features of power supply. *Why shouldn't they, as a group, sponsor an impartial and factual report by an engineering committee on some of the "yardstick" projects of the federal government?*

This doesn't mean getting into politics. It is rendering a functional and specialized service of the greatest possible value to the nation. The engineers would deal with facts and not with policies and opinions. They only are competent to speak. Is this not a worth-while suggestion for American Engineering Council to consider?

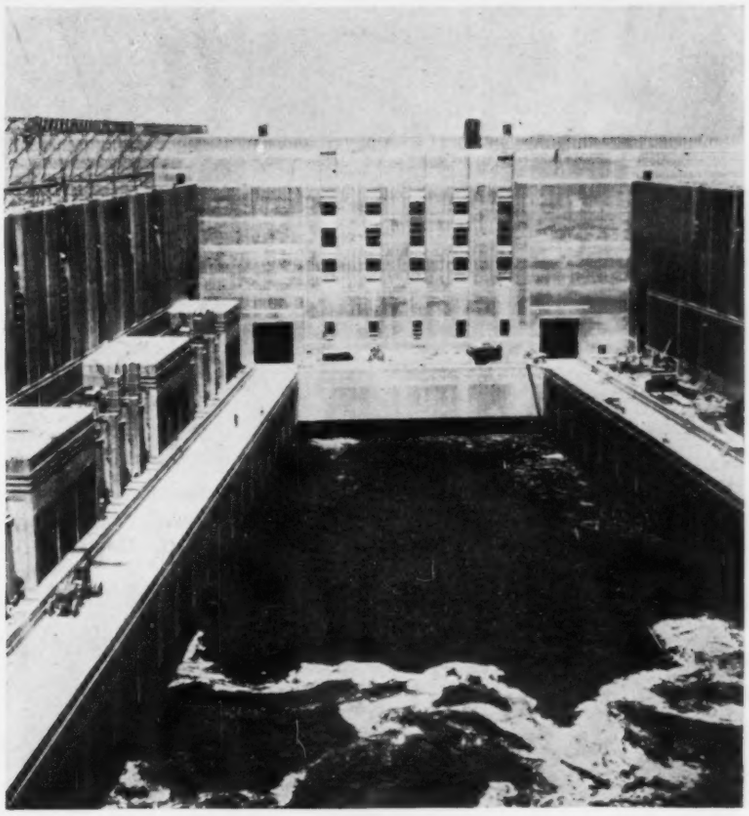
We believe the time is opportune for engineers to stand up and make themselves known both in the industry and to the nation. They should have the courage of their convictions. They face a new era for making technical and social contributions of the utmost importance. But it is up to them, and to no one else, to claim and to earn their proper place in modern affairs.

Gurney Morrow

Editor

BATTERY OF TRANSFORMERS AT BOULDER DAM POWER HOUSE

Bank of three seen from the power house wing on the Arizona side of the river. These silos and kiosks step up the generated voltage to 287,500, at which value it sets out for Los Angeles.



Power house bay on lower side of Boulder Dam shot from a cable car lowered into the gorge

A.I.E.E. Goes West

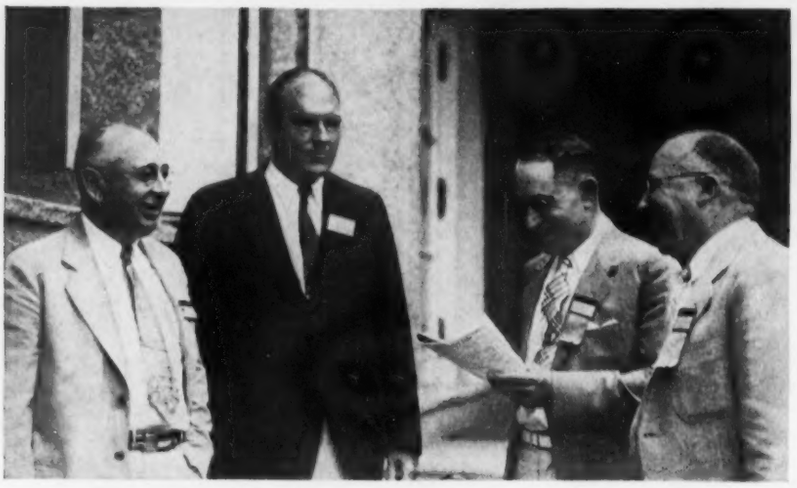
First National Pacific Coast Meeting Has 500 in Attendance — Large Party of Eastern Engineers Visit Boulder Project — Brief Report on the Technical Sessions and Events of the Convention

THE first national convention held on the Pacific Coast by the American Institute of Electrical Engineers is over. Enthusiastic comments by the 700-odd delegates and guests who met at the Huntington Hotel, Pasadena, Calif., June 21 for a week of convention activities indicate the success which attended the efforts of the Western sections of the institute in sponsoring a national meeting equal to the best yet held by the A.I.E.E. That distance from Eastern centers is no deterrent to a large attendance is indicated by the fact that 55 out of a total of the 61 sections of the institute were officially represented.

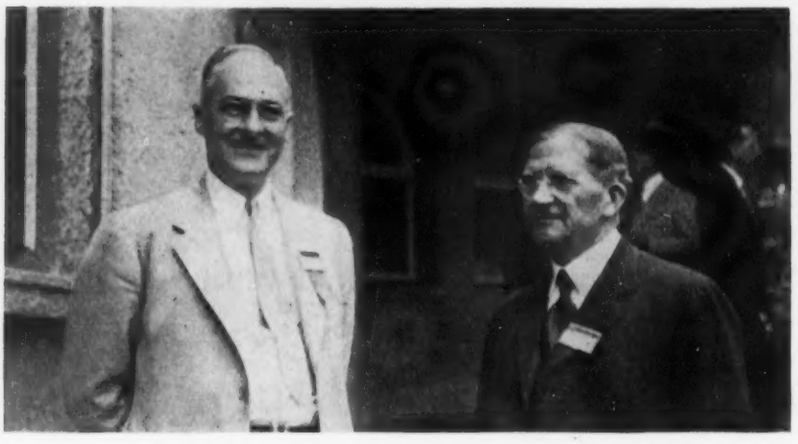
Technical sessions were uniformly excellent and the 49 papers presented disclosed investigation into a wide range of subjects and contributed valuable additional data on many phases of the electrical engineering art. The entertainment features, which contribute much to the success and enjoyment of any meeting, exploited the rich field of southern California recreational facilities to the utmost and gave Eastern visitors an unusual opportunity to become acquainted with the Southwest. Adding to the interest of the Western conclave were the many new engineering projects now in progress in that section. That pioneering and new achievement in power generation and transmission are not dormant was best revealed by the numerous inspection trips to engineering works of the various utilities serving the area. Boulder Dam, the largest power development in the world; the new transmission line of the Los Angeles Bureau of Power and Light, utilizing 287 kv. for the first time as a commercial voltage; the Long Beach steam station of the Southern California Edison Company, Ltd., and the new plant of the General Cable Company, where the type HH cable is manufactured, all embodied features of unusual interest for engineers.

City Manager C. W. Koiner, a fellow of the institute, gave the address of welcome and Prof. R. W. Sorensen responded. President E. B. Meyer in his address stressed the value of democracy in our American system and pointed out that the organization and operations of the institute were in this pattern. The institute gives engineers an opportunity to contribute and to receive, is educational and brings out the rounded responsibilities of engineers in present-day affairs. He reported the institute to be in splendid condition, with many new moves to improve its services to members and to improve the status of engineers.

The report of the board of directors substantiated his statements. Institute finances are in good shape, more meetings of sections and branches were held last year than ever before and there was a larger attendance at the meetings. A move to make unit groups of engineers in each section and to decentralize as well as organize the operations of the national technical com-



E. J. C. Wheatlake, General Electric Company, Salt Lake; D. C. Prince, General Electric Company, Philadelphia; F. J. Meyer, Oklahoma Gas & Electric Company, Oklahoma City, and Prof. F. O. McMillan, Oregon State College



C. P. Barman and E. F. Scattergood, Bureau of Power and Light, Los Angeles

mittee promises further to increase the effectiveness of the institute and to bring more engineers into active work. Many other constructive proposals were made at the meeting of the delegates from sections and branches.

Technical features of the meeting were diversified and voluminous. Formal technical sessions were accompanied by informal round-table conferences. Topics ranged from electric shock to Boulder Dam equipment. There was recorded a vast amount of new data and opinion of value to the industry. To cap the technical features Dr. R. A. Millikan gave a splendid address on "Super-Power Particles" in the cosmic realm.

New work in electrophysics

Advanced work in electrical theory was presented in the electrophysics session. A typical example of valuable work was the paper by W. G. Hoover on the field and charges about a conductor in a gaseous dielectric. This is the fundamental theory involved in corona effects and in the new endeavors to have transmission with cables made up of conductors placed in high-pressure gases. Striking pieces of data in this paper were the rectifying effect of corona and the usual "break" in the corona curve. Victor Siegfried discussed the paper and recommended still more research, using the methods outlined. K. E. Gould gave a paper on the fields caused by remote thunderstorms. J. W. McRae presented a paper on the magnetic victory potential. A. N. Garin and K. K. Paluev gave some new methods to use in transformer circuit impedance calculations and A. C. Seletzky and K. F. Sibila gave mathematical papers on current and voltage loci in polyphase circuits.

Conductor vibration studies

As a contrast to pure theory, a very practical session was held on the vibration of overhead conductors and cables. Four papers were presented. Especially valuable were the data given by Messrs. Carroll, Koontz and Sturm. A mathematical study was given by L. A. Pipes.

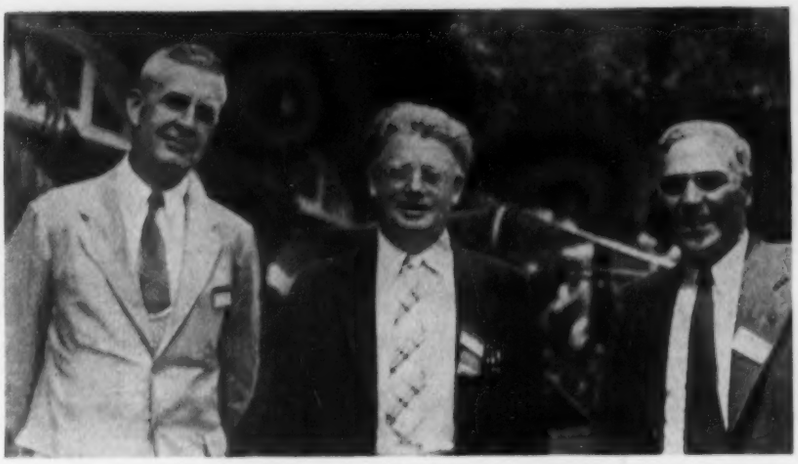
L. C. Peskin pointed out that in the complicated structure used by the cable engineer amplitude at resonance is insufficient by itself to reveal the stresses to which the individual elements of the conductor are being subjected and one must submit each type of cable to a stress analysis. If this is known, then the deflection measurements of amplitudes of vibration for given wind velocities can be of importance in revealing the magnitude of the stresses the cable elements will undergo in the field.

W. B. Buchanan commended the work of Carroll, but said the deduction that the energy taken from eddy currents of air as motive forces would be equal to the mechanical and electrical input necessary to give the same amplitude of vibration at any given frequency was subject to one objection which affects its validity for actual quantitative results. The rate of en-

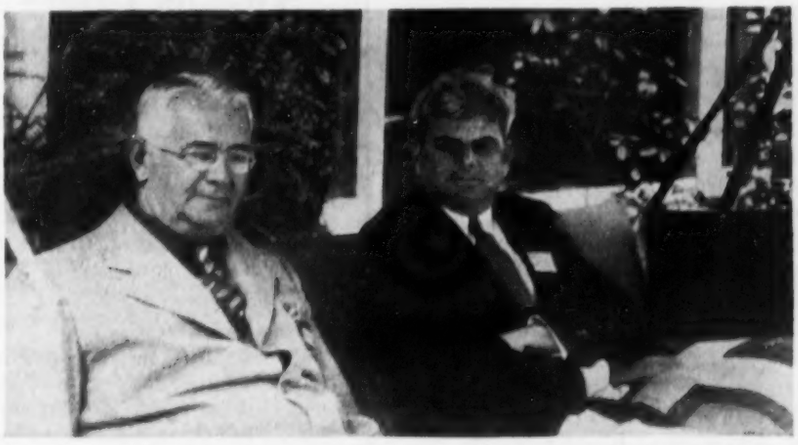
Dr. Vannevar Bush and Prof. W. H. Timbie, Massachusetts Institute of Technology

ergy loss for the two cases is not identical. This may give errors larger than the quantities measured. He pointed out that it was necessary to measure losses accurately. The reduction in effective length of span of a conductor when vibrating is compensated for by a slight reduction in sag and a higher average tension, and this loss must be accounted for.

In the paper of Mr. Sturm it was pointed out by Mr. Buchanan that standing waves cannot be set up on a flexible conductor except by a traveling wave method, and all the losses of this wave must be overcome before their components succeed in establishing standing waves. The neglect of these dynamic effects challenges the computations of Mr. Strum. Mr. Buchanan said that any mathematical approach to vibration such as used by Mr. Pipes required the introduction of empirical data and gave some of these data.



E. F. Pearson, Northwestern Electric Company, Portland; Prof. R. W. Sorenson, California Institute of Technology, Pasadena, and W. F. Hines, General Electric Company, Portland



W. K. Vanderpoel, Okonite Company, Newark, and L. M. Klauber, Consolidated Gas & Electric Company, San Diego

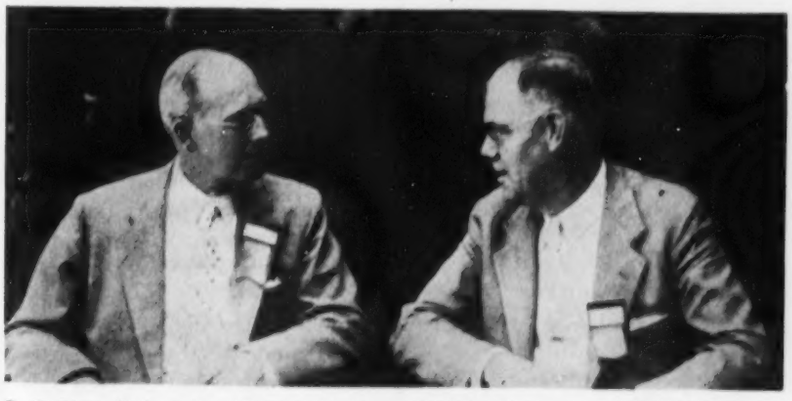
Dielectric advances

On Wednesday a great deal of discussion was given to the papers of H. H. Race on impregnated paper and D. H. Rowland on high-voltage insulators made from porcelain. L. V. Bewley presented a paper on line flashovers, E. Weber and F. E. Kulman a paper on sinusoidal traveling waves and R. L. Webb and O. W. Manz, Jr., on impedance measurements on underground cables. W. F. Davidson suggested the use of the alternating-current potentiometer for these cable measurements as it is now perfected. G. L. Gilkenson pointed out that cable impedance measurements by the zero-sequence method is only an approximation because of parallels and that the value for currents under 600 amperes will depend upon the value of the residual current used in the tests. He gave another experimental method of measurement recently developed and the steps to be used in a general solution.

In discussing high-voltage porcelain insulators Dr. J. B. Whitehead said that electrical properties are completely subordinated to those of mechanical strength. If the mechanical design is liberal electrical design, generally speaking, will take care of itself. But the major problem is mechanical design, and porcelain has about the worst mechanical properties that could be had for the support of overhead lines. The paper is of great value in showing the importance of internal compression and tension in the surface layer and in the control of these forces by the control of the glaze.

J. J. Torok stated that glass also could be improved in mechanical properties by having the surface in compression. This is done by controlling the cooling. Strength of the glass may be increased fourfold by proper methods.

Many complimented Dr. Race on his new test methods for use on impregnated paper. L. J. Berberich suggested caution, however, since the tests are accelerated, the specimens small and the micro-methods must be amplified. Chemical changes are small, and this makes it doubly difficult to evaluate them. The few results given bear this out because no conclusions can be drawn. He suggested care in having



G. G. Post, Milwaukee Electric Railway & Light Company, and N. B. Hinson, Southern California Edison Company

L. J. Moore, San Joaquin Light & Power Co., Fresno; J. O. Henkle, R. R. Robley and O. B. Coldwell, Portland General Electric Company, Portland; Hugh Laidlaw, Pacific Gas & Electric Company, San Francisco, and Lorin Nott, Sangamo Electric Company, San Francisco

proper tension on the paper and the use of at least triplicate specimens.

Herman Halperin pointed out that both oil-immersed and solid cable differed from the test conditions. He related data to show that negative ionization causes chemical deterioration rather than gaseous ionization. W. F. Davidson said the method was to be commended, but the paper showed no data to support the conclusion that results were reproducible. The method must be further developed before it will meet all the requirements. Dr. Whitehead also commented upon the absence of uniformity of result and of quantitative relationships sufficiently repeated to warrant general conclusions. The test set-up is splendid, but the data are as yet incomplete, or at least insufficient to support some of the conclusions made. The paper does raise the question that the probable causes of deterioration lie in chemical properties of oil and minute physical differences in oils. This contradicts the theory of oil failure by ionization by collision.

Hydrogen cooling of machines

A new phase in the art is the use of hydrogen cooling of elctrical rotating machines—generators, condensers, and frequency changers. This topic was of great interest at the meeting. C. M. Laffoon and G. W. Penny each presented a paper on the topic. In discussing the subject S. S. Mortensen (Allis-Chalmers chief engineer) said hydrogen cooling permits the designer to build larger higher-speed machines. The added advantages of hydrogen cooling for the higher speeds may come in the future through some form of refrigeration and the development of insulating materials that will operate at higher temperatures. It is possible to have larger copper and iron losses with hydrogen cooling so that the reduction in windage loss is perhaps offset. R. E. Hellmund said that the use of gas raised the question of why not use liquids? Designs have been made for complete cooling of both stator and rotor with liquid, but there is as yet too much risk involved in this method. D. M. Ross said that the larger machines made possible by hydrogen cooling seemed to fix this scheme as a definite trend in the art.

R. H. Norris discussed the paper by Mr. Penny and the derivation of quantitative relations. He considered that both the test and theoretical values given by the author are of uncertain significance as individual data, but the ratio of these values to air and to hydrogen give an indication of the order of magnitude of the ratio which may be expected for the total heat transfer for these two gases.

A new development in a synchronous mechanical rectifier was described in a paper by Messrs. S. S. Seyfert, N. S. Hibshman and D. C. Bomberger. Dr. Vannevar Bush commended the paper. He pointed out the state of flux that now existed in the a.c.-d.c. conversion problem and said that mechanical rectification such as described seemed to have a place in intermediate voltage ranges. Others papers on machinery were presented, including one on salient pole motors out of synchronism by A. H. Lander, stray load tests by T. H. Morgan and V. Siegfried and an analysis of unsymmetrical machines by W. V. Lyon and Charles Kingsley, Jr.

A miscellaneous group of papers on measurements was presented. The sparkless sphere gap voltmeter described by R. W. Sorensen and Simon Ramo proved interesting. Dr. Whitehead commended the idea of using the force of attraction between spheres as a measure of voltage. But even this method does not eliminate the influ-

A.I.E.E. Awards Prizes for 1935

•

National Best Paper Prizes in Three Fields

Engineering Practice

"Engineering Features of the Boulder Dam-Los Angeles Lines," by E. F. Scattergood, Bureau of Power and Light, City of Los Angeles.

Theory and Research

"Wide Band Transmission Over Coaxial Lines," by Lloyd Espenchied and M. E. Strieby, Bell Telephone Laboratories, Inc.

Honorable mention:

"Sparking Under Brushes of Commutator Machines," by R. E. Hellmund and L. R. Ludwig, Westinghouse Electric & Manufacturing Company.

Public Relations and Education

"On the Schooling of Engineers," by Alex Dow, president Detroit Edison Company.

National Prize for Initial Paper

"A New Timer for Resistance Welding," by R. N. Stoddard, Westinghouse Electric & Manufacturing Company.

Honorable mention:

"D. C. Braking of Induction Motors," by F. E. Harrell and W. R. Hough, Reliance Electric & Engineering Company.

National Prize for Branch Paper

"A Direct Current-Controlled Transformer Regulator," by P. H. Odessey, Brooklyn Polytechnic Institute.

ence of surroundings, and great values is had from the analysis of these effects as given in the paper. He suggested that possibly the use of planes instead of spheres might reduce these effects. Measuring equipment for power factors of oils was described by L. J. Berberich. Otto A. Knopp gave a paper on instrument transformer applications that was commended and discussed by F. B. Silsbee. He pointed out the advantages of being able to measure values without sending instruments to the Bureau of Standards. Stanley Green also contributed a good discussion on instrument transformers and agreed with Mr. Silsbee that the material in the Knopp paper should be expanded.

Leo Scanlon, Buffalo, N. Y.; Mark Eldredge, Memphis Power & Light Company, Memphis, and H. B. Gear, Commonwealth Edison, Chicago

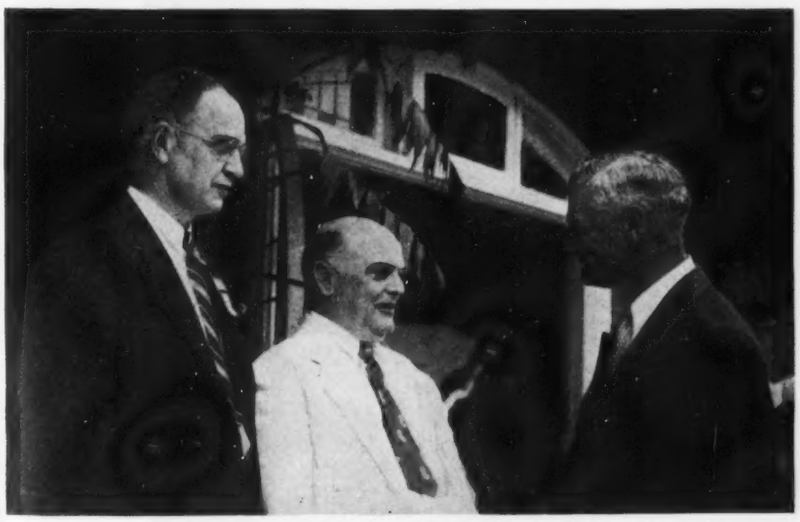
Electric shocks

Two papers giving much valuable data on electric shocks were presented. More data on the research into shock effects on the heart were given by L. P. Ferris, P. W. Spence, B. G. King and H. B. Williams and this paper was enlivened by an oscillographic and sound demonstration of great interest. Shock effects on frequency data were given in the paper by W. B. Kouwenhoven, D. R. Hooker and E. L. Lotz. Warning on any endeavor to apply data on shocks obtained on animals to men was given by Wills Maclachlan and he also questioned some of the quantitative conclusions made, especially the statement that about 0.1 amp. is a threshold value for ventricular fibrillation. He also said values and effects may vary with species rather than only by reason of body and heart weights.

An interesting description of the new 287.5-kv. Boulder transformers was given in a paper by W. G. James and F. J. Vogel. Transformers with concentric windings were discussed in a paper by K. K. Paluev. A paper on the exact formula for transformer regulation by J. E. Clem and another on over-refined oils for transformers by J. G. Ford rounded out a session on transformers. Dr. Whitehead challenged the use of the word "exact" in the paper by Mr. Clem, since the author neglected exciting current and its effects. The formula is justified in practice, but it should not masquerade as being exact, in the opinion of Dr. Whitehead.

Illumination advances

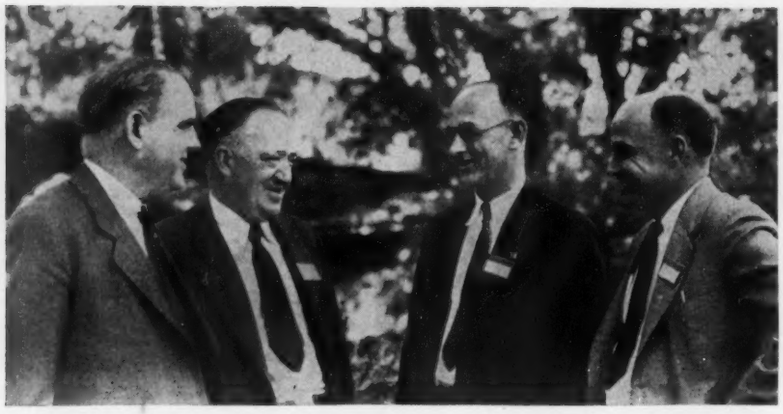
Lighting developments still receive the attention of engineers and three good papers were presented and discussed at the meeting. P. S. Millar discussed the qualities of incandescent lamps, L. A. S. Wood advocated better visibility on highways at night and C. A. B. Halverson gave a paper on principles and sources for highway lighting. M. A. Babb discussed the economic desirability of the 1,000-hour lamp and suggested that the lower the rate and the greater the cost of replacement the longer the life of the lamp should be. He suggested that industrial and commercial lamps on low rates are more economical at 2,000 than at 1,000 hours and that the formula given by Mr. Millar neglected the total cost of lamp replacement. Much good information on highway lighting was brought out showing the trends of the day to use safety as the major argument for better highway lighting.



H. H. Henline, A.I.E.E., New York; E. B. Meyer, A.I.E.E., New York, and A. W. Copley, Westinghouse Company, San Francisco

Protective devices received attention at one session. Several papers were presented. The Boulder Dam circuit breakers were treated by H. M. Wilcox and W. M. Leeds. This type used multiple breaks for 3-cycle operation. A. W. Copley pointed out that the problem of voltage distribution had been solved and that speed requirements fixed the type of design. D. C. Prince complimented the authors on solving some exceedingly difficult problems in the design. He pointed out that the order of duration of the arc was 1¼ cycles, as compared to about 0.6 cycle in the impulse type.

A new type of test for circuit breakers was presented by W. F. Skeats. This was designed to give tests that would eliminate the necessity of using high-capacity laboratory tests. Dr. Joseph Slepian challenged the results



Oliver R. Grant, General Cable Corporation, San Francisco; Roy Wilkins, K. P. F. Switch Company, San Francisco; E. A. Crellin, Pacific Gas & Electric Company, San Francisco, and R. D. Likeley, San Joaquin Light & Power Company, Fresno

and conclusions. While stating that the objective was desirable, he did not think the tests or the data shown supported conclusions made. Mr. Prince said the test was not a completed research project, but only a promising and needed approach to the problem of breaker tests. A. J. Bowie presented a paper on the 287-kv. disconnects for Boulder and pointed out the advantage of silver contacts and area contacts. A description of a faster carrier-current pilot-relay system was presented by O. C. Traver and E. H. Bancker. A new distance ground relay was described by S. L. Goldsborough and R. M. Smith. Good data on the performance of distance relays were given in a paper by G. Calabrese. A unique scheme using a neutralizing transformer to protect power station communication was described by E. E. George, R. K. Honahan, L. L. Lockrow and E. L. Schwartz.

Education seeks changes

Two papers and a panel discussion on engineering education proved valuable and interesting. R. E. Hellmund discussed the position of young engineers under changed conditions and M. King and O. W. Eshbach gave a paper on general trends in engineering education. An interesting comment from A. Naeter described a new general engineering course at Oklahoma A. and M. College. L. A. Doggett suggested that the economics found desirable for young engineers by Mr. Hellmund was not the classical type, but the modern business type, and seldom available in economic departments.

Another interesting feature of the meeting was a program containing papers prepared by students. Several of these were of high caliber and well written.

While the engineers were busy at formal sessions there was also a series of round-table conferences that were well attended. These conferences brought interested men together to give informal discussions on mechanical properties of conductors, synchronous machines, transformers, electron tubes in industry, carrier currents and high-voltage tubes. Especially interesting were the conferences and discussions on electron tubes applied to therapeutic uses. Not much is known apparently about the fundamental effects of the new electrical treatments of human beings.

Round-table conferences

Dr. Vannevar Bush, vice-president of the Massachusetts Institute of Technology and dean of its engineering school, was awarded the eighth Lamme Medal, the institute's recognition for meritorious achievement of mathematical analysis of engineering problems which have been of outstanding value to engineers.

Discharges 10,000 sec.ft. of water to supply the lower river at Boulder Dam

All-Electric City Provides Heating Data

Widely Publicized as the City Without Chimneys, Mason City, Wash., Has Had a Year's Experience With All Completely Electrified Homes*

DURING 1935 Mason City, Wash., with a connected load of 12,250 kw., consumed 12,301,630 kw.-hr. of energy. This power provided lighting, appliance service, refrigeration, cooking, water heating and house heating for the entire city of 3,000 population. Buildings in the city include 288 residences, 114 bunkhouses and nineteen mess halls, business establishments and central lavatories. Operating data over a full year's period of seasons provides a basis for calculations and speculation regarding the future of electric heating.

Economics and the necessity for speed in construction dictated the selection of electric heating (see ELECTRICAL WORLD, December 21, 1935, page 36, "Electrically Heated Homes at Mason City," by H. G. Bender, for details). Briefly, the first cost of residence heating installations using a coal fire central heating plant was $300 each exclusive of basement. The first cost for the completely electrified house embracing house heating averaged $181.50, including the extra investment of $13,575 needed to increase the carrying capacity of the distribution system for the excess load involved in electric house heating.

Loads of 25-30 kw. per house

For the nineteen blocks of bunkhouses a central heating plant would have cost $210,000. The total cost of electric heat for the 114 24-man bunkhouses was $76,900. On the basis of the foregoing figures it was only natural to select electricity as the source of heat for the entire city.

A typical block in the residential area contained eight houses served from a bank of three 50-kva. transformers with the following electrical load:

4 Four-room houses, 29.5 kw. each . 118 kw.
Lights and appliances, 2 kw. each
Cooking, 8.5 kw. each
Water heating, 2.5 kw. each
Heating, 16.5 kw. each

8 Three-room houses, 29.5 kw. each 212 kw.
Lights, appliances, cooking and water heating same as five-room houses.
Heating, 13.5 kw. each

In the 4-room type "C" houses the heating installation consisted of five Wesix heaters as follows: Living room 5 kw., kitchen 3 kw., bedroom 4 kw., bedroom 3 kw. and bathroom 1½ kw. In the 3-room type "B" houses the installation was identical except for the elimination of the 3-kw. bedroom heater.

Each of the nineteen blocks of bunkhouses was served also from a bank of three 50-kva. transformers and each block consisted of the following:

5 Twelve-room bunkhouses, 30 kw. each ..... 150 kw.
Lights, 2 kw.
Heat, 28 kw.

1 Eight-room bunkhouse ..... 32 kw.
Lights, 2 kw.
Heat, 30 kw.

1 Lavatory ..... 43 kw.
Lights, 2 kw.
Water heaters, 28 kw.
Heat, 13 kw.

In the twelve-room, 24-man bunkhouses a 3-kw. heater was installed in each of the four corner rooms and a 2-kw. heater in the remaining eight. The foremen's bunkhouses contained a 6-kw. heater in the recreation room, two 1-kw. units in the hall, 3-kw. heaters in two of the bedrooms and 2-kw. units in the other six, a 1.5-kw. heater in the bathroom and a 2-kw. unit in the lavatory.

The complete electric heating installation at Mason City comprises approximately 3,000 Wesix heaters of various capacities. In the heating installation no advantage was taken of automatic temperature control nor of insulation. In addition there were no limitations on use.

90 kw.-hr. per room on maximum day

Data on the monthly consumption of 215 houses, of which 88 were of the four-room type and 127 of the three-room type, are contained in the accompanying table. Average annual consumption of the 29.5-kw., four-room houses was 21,770 kw.-hr., or a monthly average of 1,814 kw.-hr. For the three-room, 26.5-kw. houses the average annual consumption was 17,480 kw.-hr., or a monthly average of 1,456 kw.-hr. Maximum monthly

[*Continued on page 80*]

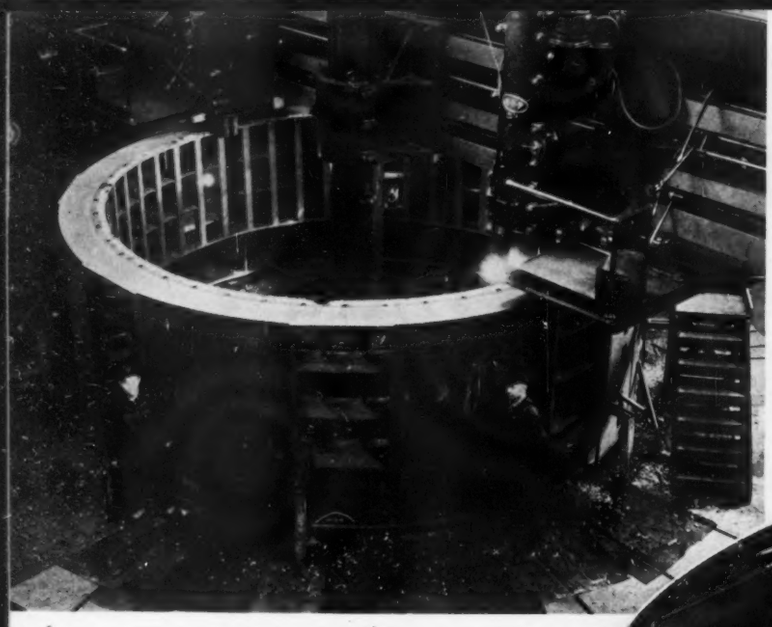
Monthly Consumption for 215 All-Electric Houses at Mason City for 1935

Month	Total Consumption, Kw.-Hr.	Heating Only, Kw.-Hr.	Mean Monthly Temp., Deg. F.
January.....	636,870	510,308	28.9
February.....	516,288	389,726	38.3
March.....	432,557	305,995	42.1
April.....	397,596	280,064	....
May.....	191,885	74,353	....
June.....	129,827	12,295	....
July.....	117,322	.....	....
August.....	116,987	.....	....
September.....	132,220	14,688	....
October.....	227,062	101,500	....
November.....	602,071	475,509	32.6
December.....	645,931	519,369	29.3

*Abstracted from paper by Juan Hargrove, architect for Mason-Walsh-Atkinson-Kier Company, contractors for the dam, presented before the San Francisco Chapter, Electrical Heating Society.

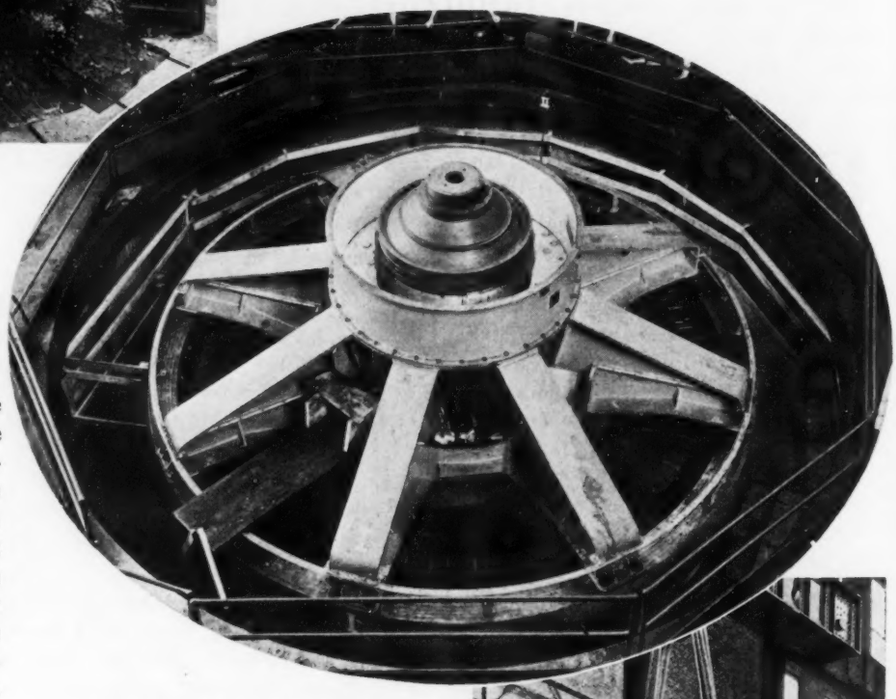
Today's Design

By S. H. MORTENSEN
Allis-Chalmers Manufacturing Company, Milwaukee, Wis.



Assembly for shop tests

Here again appears the replacement of large castings by welded construction. Observe the partially completed housing surrounding the thrust bearing in which the oil cooling coils will be installed.



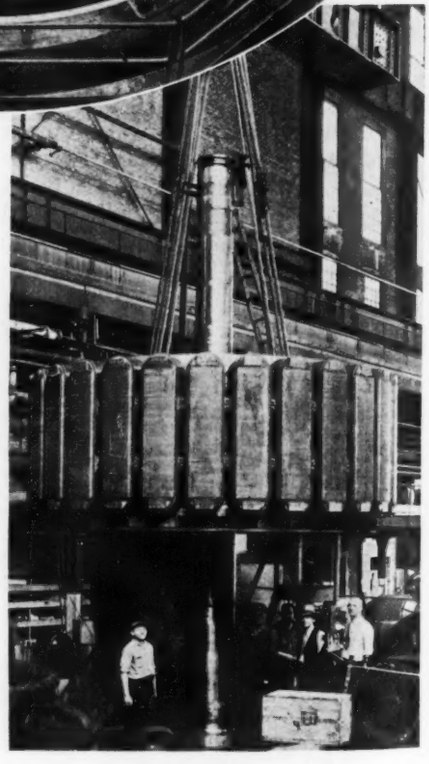
Machining the stator yoke

In this shop picture can be seen the welded construction, combining maximum provision for circulation of cooling air with more than adequate structural strength and rigidity. Note the apertures in the yoke, eight of them around the periphery, where the cylindrical water-cooled air coolers will be mounted.

PROGRESS that has been made in generator design since the days not so long past when guarantees were limited to temperature rises, excitation and voltage regulation is indicated by the specifications that were set up for the machine which Allis-Chalmers recently completed for Boulder Dam. They called for a Class B insulated, 40,000-kw., unity power-factor, 13,800-volt, three-phase, 60-cycle, 257-r.p.m. vertical generator with direct-connected main and pilot exciters and self-ventilated by inclosed cooling air system. The main exciter is rated at 125 kw., 250 volts and the pilot at 7 kw., both mounted at the top of the unit. The guarantees required and instances of how satisfactorily they were met in shop tests appear in an accompanying tabulation.

The stator yoke is of welded construction and so designed that generator air coolers may be mounted around the periphery of the machine. Stator punchings are of high-grade silicon transformer steel held securely by dovetails in the yoke. Stator coils consist of three turns of stranded con-

Significant advances in the art of building slow-speed, high-capacity generators appear in the design of the 257-r.p.m., 40,000-kw. machine recently shipped from the Allis-Chalmers shops for installation at Boulder Dam. Welded construction, recirculated air in a completely inclosed cooling system, self-contained thrust-bearing lubrication, special provisions for avoidance of eddy currents in coils and structural parts are among the features of this machine.



Rotor ready for test

Assembly of the rotor was greatly facilitated by expanding the spider rim and shrinking the shaft. The rim was heated by circulating current through the field coils and dry ice was placed in the hollow shaft to cool it.

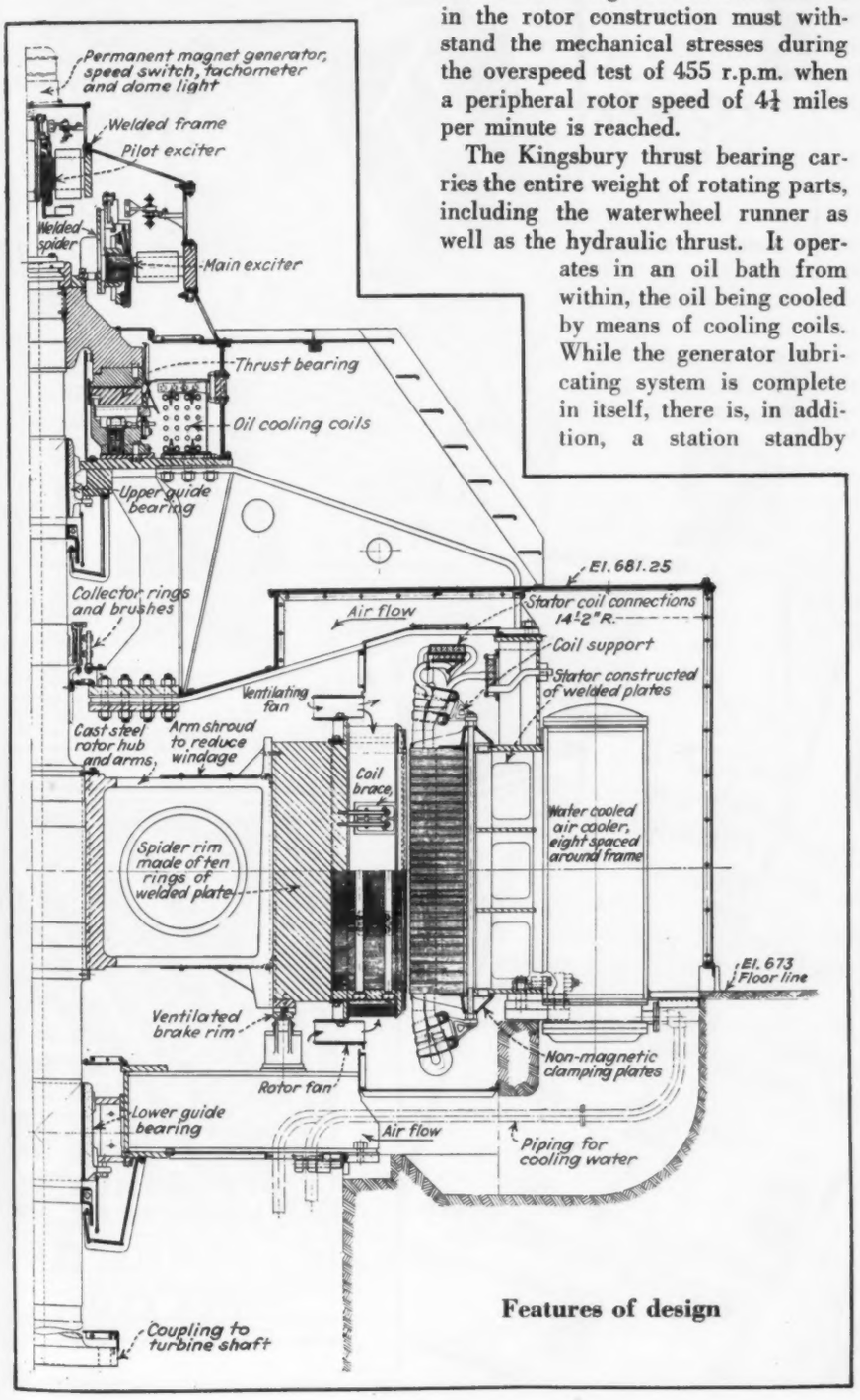
for a Waterwheel Generator

ductor completely transposed to eliminate eddy currents between strands, and are of the standard double-layer type. A carefully proportioned and insulated bracket system is devised to support the stator coil ends to prevent distortion during short circuits.

The rotor is comprised of a cast steel hub with arms transmitting turbine torques and carrying the weight of the spider rim, which in turn supports the rotor poles and coils. The spider rim consists of a number of rings built up from boiler plate segments welded together. Materials used in the rotor construction must withstand the mechanical stresses during the overspeed test of 455 r.p.m. when a peripheral rotor speed of 4¼ miles per minute is reached.

The Kingsbury thrust bearing carries the entire weight of rotating parts, including the waterwheel runner as well as the hydraulic thrust. It operates in an oil bath from within, the oil being cooled by means of cooling coils. While the generator lubricating system is complete in itself, there is, in addition, a station standby lubricating system which can be operated and used to supply the lubrication when desired. A panel arrangement mounted on the governor floor affords complete control of the entire lubricating system and cooling coils.

Ventilation of the alternator is accomplished by means of rotor-mounted fans which force the cooling air over the stator coils, between the rotor coils into the air gap, and up through radial ducts in the stator, thence discharging radially outward to the water-cooled air coolers spaced equally around the periphery of the machine. The cooled air is then guided through suitable air housings and ducts back to the generator.



Features of design

Guarantees and Results of Shop Tests

Full-load operating temperature of stator and rotor, with station air at 52 deg. C., not to exceed 100 deg. C.

	Guarantees	Test Results
Efficiency at full load (per cent) Not less than	97	97.7
Field excitation at full load (amp.)	350	330
Regulation with full load thrown off (per cent)	11	10
Short-circuit ratio	1.6	1.63
The unsaturated direct axis transient reactance (per cent)	26	26.7
Telephone interference factor:		
No-load balanced	50	below 50
No-load residual	30	below 30
Line charging capacity (kva.)	48,000	.....

Values of symmetrical short-circuit currents with excitation corresponding to full load at unity power factor.

	Initial Current	Sustained Current
Three-phase short circuit (amp.)	9,700	3,375
Single-phase terminal to terminal short circuit (amp.)	7,500	4,160
Single-phase terminal to neutral short circuit (amp.)	10,600	6,450
Time required for initial three-phase short circuit to decrease by 63 per cent (seconds)	....	1.31

	Guarantees	Test Results
Rotor WR^2 ($ft.^2$ lb.)	10,000,000	.....
Thrust-bearing capacity at 455 r.p.m. (lb.)	680,000	.....
25 deg. C. cooling water required for cooling generator (g.p.m.)	550	.....
25 deg. C. cooling water required for thrust bearing (g.p.m.)	60	.....
Puncture test—stator (volts)	28,600	28,600
Puncture test—rotor (volts)	5,000	5,000
Puncture test between field turns (volts)	40	.....
No-load voltage wave deviation factor (per cent)	5	4.86

The full load heat run test will be made after erection of the unit. From preliminary compromise heat runs, it appears the guaranteed temperature rise will be met satisfactorily.

Can Purchased Power Be Advertised?

"Yes," answers a group of power salesmen who do not know it cannot be done and are doing it

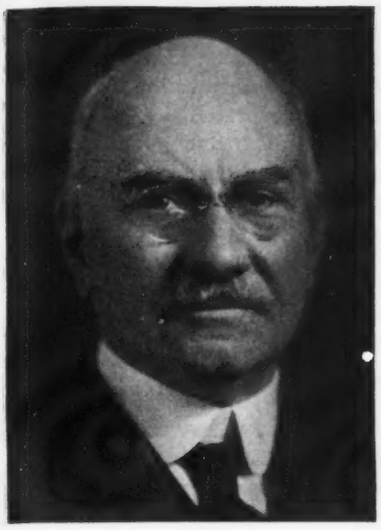
CENTRAL-STATION POWER is a commercial service competing in the industrial market with power locally produced. Local power generation, in terms of the equipment required for it, is extensively and intensively advertised in the trade and technical publications of every industry. Yet except for what is represented on this page, there is no advertising of purchased power in these publications.

Why is it that local power generation has practically a monopoly of use of advertising in industrial periodicals? Why is it that central-station power does not employ this potent selling tool?

Because such advertising is a matter of national coverage and electric utilities are isolated businesses and it is

[*Continued on page 100*]

OIL MEN!
Solve your Power Problems by asking
POWER MEN
for their co-operation
Your Power Company will help you
Electricity
POWER BY WIRE
Boost Profits with ELECTRIC POWER
COST FINDING EASY with ELECTRIC POWER
THE SILENT SENTINELS of Dependable Service
Electricity
HAS MANY FRIENDS
....UP AND DOWN THE PIPE LINES
WHEN A WELL WON'T FLOW
ELECTRIC POWER...
PURCHASED ELECTRIC POWER PUTS ITS MIGHTY SHOULDER
The TRUTH about ELECTRIC POWER
DIAGNOSIS FREE
New Light on PIPE LINE PUMPING
THIS FIELD PUMP and thousands of others have been OPERATING FOR YEARS on PURCHASED ELECTRIC POWER
Power Company
CUT PRODUCTION COSTS WITH PURCHASED ELECTRIC POWER
The Cost Line Always Takes A DROP!
ECONOMY by WIRE
SAVE WITH ELECTRIC POWER
PETROLEUM ELECTRIC POWER CLUB



Critique on Electrical Industries in Japan

Professor Jackson Presents Intimate Portrayal of the Industrial Status and Expectation of the Industrial Empire of the Orient

By **DUGALD C. JACKSON**
Massachusetts Institute of Technology

IT IS TIME for American manufacturers and American exporters of manufactured products to discard the oft-repeated view that the Japanese are mere copyists and that their success as competitors for international trade in manufactured products is a temporary phenomenon which will prove to be a flash in the pan. The facts are quite the contrary. An early facing of the facts by American manufacturers and exporters will facilitate serviceable adjustments of trade relations, and it also may improve diplomatic relations between the Orient and the Occident. The observations made possible by two visits to Japan six years apart and each one of many weeks' duration, in each of which visits considerable time was spent in studying Japanese industrial processes and their results, lead the writer to the foregoing opinions.

If any one doubts the accuracy of the opinions let him study Japanese industry on its home ground and also there consort and converse with Japanese industrial people. If open-minded he will be convinced. A flying visit is not sufficient to afford grounds for conclusions, because the facts in this problem are jointly bound up with (among other things) Japanese knowledge of science, Japanese experience and ability in organization, the conditions which afford favorable living for workpeople in Japan and the intelligence of available work-people. The truth regarding these important features cannot be observed in a passing glance, tourist fashion. It also is a fact that the Japanese have made great improvements in their industrial ideas and practices during the past half-dozen years, so that conclusions based on former observations alone are likely to be unsound.

Many successive generations occupied with home handicrafts have left firmly established habits of the people in Japan, and the development of mass industry has not eradicated the home and village industries which give incidental or complete occupation to many people. The industrial situation of the nation, therefore, is mixed, and control of quality of goods for export has been an embarrassing subject during the period within which Nippon has so rapidly made its large place in international trade in manufactured products. Certain lines of goods, such as cotton and rayon cloth, heavy machinery, and so on, have not deeply suffered this embarrassment, but in other lines of production the embarrassment has been great.

Tutor of a generation of M.I.T. electrical men, Dugald Jackson followed his retirement from active teaching by a new sojourn in Japan. This time it was to give a series of lectures under the Idaware Foundation. In them he portrayed the American relationship of technical industry to technical education. Here, he hands us the binoculars to look at the incidence of commercial evolution upon the empire aspirations of Nippon

For illustration, the production of raw silk (the greatest of Japan's export raw products) is mostly the result of home industry of peasants and others occupying plots of land that are minute in area when considered from the western point of view, and control of the quality of cocoons and the reeling of the silk has been a problem difficult to solve. A large part of the reeling is now executed at central filatures, where girl-tended machinery operated under seasoned supervision does satisfactorily uniform work. Also, all bales of raw silk which get legitimately into export trade are now inspected at one of the government silk-conditioning laboratories, and silk which fails to meet specifications is refused export privileges. Two of these silk-conditioning laboratories, excellently equipped and operated, are in operation at the great exporting ports of Yokohama and Kobe, one such laboratory being located at each of these ports. It is understood that similar plans are afoot for inspecting Japan tea which is intended for export and for other products (among which are incandescent electric lamps).

Japanese are astute industrialists

To one who has given study to Japanese industry on its home ground at intervals of a half dozen years, as has been the writer's fortune, it becomes obvious that the Japanese are astute industrialists and that they continue to improve their manufacturing practices. Moreover, the development of capital in Japan is progressing with speed, but the need of still more capital produces an urgent desire to increase export trade in manufactured goods. Japan is

squeezed in the vise of popular will. The nation is deeply affected by the impact of the forces set up by industrialization and the Japanese people do not think that they have yet gone far enough in developing foreign markets for their manufactured products.

The often-expressed view that the Japanese always will be copyists and followers in their industrial processes and production has been proved to be wrong by the developed status of industry and invention in Japan. The nation now seeks to secure an additional margin for modern conveniences, comforts and recreations. Its citizens claim assurance of continuity in the provision of food, clothing and shelter at more than a minimum level capable of conserving life; that is, these citizens seek comforts in addition to a minimum of necessities, and the nation seeks to establish conditions whereby these desires may be satisfied. Japan could not meet this challenge until its population had become competent to originate and manufacture instruments and machines that meet its own needs for accurate measurements and until it had become competent to employ exact standards of production which are limited by exactly defined narrow tolerances.

When destitute of this ability no nation can meet the challenge of itself providing conditions under which its citizens may by fair and equitable processes secure for themselves provisions that are more than sufficient to maintain a bare and meager life. Until the independence of its population from the defects of crude measurements is achieved, any nation must continue to rely on others for desired manufactured products of assured quality and its population are likely to remain in poverty. Crude agriculture, fishing, hunting and crude artisanship maintain savages, but the greater desires of civilized men require for their satisfaction the addition of complex products produced at reasonable costs by means of organized manufacturing. Moreover, prices within the reach of all for manufactured products of assured quality usually are available only from the result of fast and precise workmanship executed by machinery, which result is dependent on exactness of standards and accuracy of measurements.

Now well competent to stand alone

The Japanese struggled with the situation as industrious copyists for several decades of their development of manufacturing industries, but they faced the challenging conditions resolutely and now are well competent to stand on their own feet. They are yet relatively new as an industrial nation and will learn farther by observation and experience, but the fundamental requirements are now well understood by them. Applied-science research of effective order, stimulation of invention and resourcefulness in the design and construction of machines and structures, productive improvement of manufacturing processes and manufactured products and appreciation of the principles of rigorous organization have all been introduced as component parts of Japan's practices in producing effective and permanently influential industrial results. The Japanese are an able race. Stale minds do not produce greatness in design of machines and structures any more than they do in the production of poetry, and the Japanese distinguish themselves in both fields.

The dominant Japanese engineering industries (that is, industries in which the products are manufactured in great quantities by machines) are in fields occupied by dominant industries throughout the world. That is a misfortune for Japan, but being, in general, short of raw materials of her own, except those from which luxuries like silk and tea are derived, she has felt that she must direct the bulk of her manufacturing toward articles which may be readily produced from raw materials that are cheaply and continuously obtainable in world commerce. Cotton textiles (although the raw cotton must be imported), rayon yarns and rayon textiles, iron and steel products (although a good part of the iron ore must be imported), porcelain table ware and other clay products, the output of shipyards, machine tools and other machinery (including measuring instruments and machines), and so on, are among Japan's principal manufactures. Chemical manufacture, especially directed toward artificial fertilizer, is coming into extensive vogue.

A few years ago the morning traffic on the highways leading out of Tokyo was in large proportion made up of an amazing number of carts hauling the household excrement from the cesspools of the city to be used as the natural fertilizer then considered necessary for the surrounding productive fields. This traffic has largely disappeared as the construction of sewers has progressed in the city. Recently a Japanese engineer, reminded of the old-time tradition of the economic necessity for this fertilizer, disposed of an inquiry regarding the outcome resulting from sewer construction by the observation that "sanitation must take precedence." Thus, the manufacture of artificial fertilizer apparently has come to stay. The canning and exporting of seafoods, such as fish and shellfish, is (like manufacturing clay products) an example of the few extensive industries for which Japan possesses its own major raw materials in sufficient amount.

Basis of electrical prominence

It is necessary to have such facts regarding Japan in mind if one is to understand the prosperity of the electrical industries in that country with its population of very small individual incomes. Such facts also aid in disclosing reasons for the keenness of Japan's struggle in the arena of world commerce, finance and diplomacy. The progress made by the electrical industries of Japan during the last decade has been great, and the prosperity of these industries indubitably will continue as long as Japan's exports of industrial products are large, although the extent of export of electrical equipment itself is not now relatively large. This comment applies to all aspects of the electrical industries, whether relating to the heavier power aspects or the lighter aspects, which include electrical communication and radio broadcasting. The early stages of the Japanese electrical industries were aided by American and other foreign capital and management, but the management now is mostly Japanese, though in some instances foreign companies maintain more or less intimate advisory relations.

There are now in Japan three manufacturing companies competent to design and construct large generators for steam-turbine and hydraulic-turbine sets as well as large generators and motors for other purposes. Either themselves or through affiliates, these companies manufacture the turbines. The same companies and many others manufacture a wide range of electrical machinery of smaller types and caliber. The annual output of these factories runs into a large annual sum. The factories are busily occupied and seem to be on a profitable basis. General sentiment in this field seems to anticipate a continuation of satisfactory demand for electrical machinery for several years.

Most of the product is absorbed in Japan and its affiliated Manchukuo, and there may be some sense of insecurity

on account of the ultimate saturation of this market, but China and other Oriental regions are awakening to the larger use of electricity for light and power and a spirit of optimism prevails in electrical-machinery circles. The greatest rated capacity of individual electrical machines yet designed and constructed in Japan is 50,000 kva., in steam-turbo generators. Generators of 75,000 kva. individual capacity have been designed and are likely to be constructed for further extensions of plant. Japanese engineers lean toward 3,000 revolutions per minute (50 cycles per second) for large steam-turbine generating sets.

Their generating sets run excellently and reliably. Specific figures for steam economy do not seem to be available. In hydro-electric generators even larger machines, relatively, although of smaller rated capacity have been built, such as individual capacities of 35,000 kva. Japanese hydraulic work is typically in plants of high head, compared with most of the large plants of America which are east of the Rocky Mountains. The only sites for satisfactory low-head plants of any considerable magnitude are in Manchukuo, and the extent to which these will be developed is yet uncertain. The large hydro-electric generators are, therefore, of higher speeds than most of ours which are east of the Rockies. Their operating characteristics give the impression of reliability and excellence and the Japanese have proved themselves to be excellent designers and constructors of power generating plants.

Designers and constructors competent

As the Japanese generally-used standard voltage for high-voltage power transmission is 135,000 volts, the transformer and switchgear problems are less pressing than in the largest American transmission situations. The Japanese are successfully building both three-phase and one-phase transformers of large individual capacities, more or less following conventional designs. The oil-switchgear practice appears typically like that of America in some of our moderate-sized networks. Switchgear in the electric power networks of centers like Tokyo and Osaka must cope with normal distribution loads of many hundred thousand kilowatts, but there is no case in Japan of any electric-power network rivaling the magnitude of the greatest American networks. However, a visitor is impressed by the many transmission lines from various directions which enter active industral areas like Osaka and adjacent cities.

Coal is of moderate price in Japan and power generation from fuel is a definite and important reliance, but the Japanese have developed and continue to develop their available water power wherever convenience and economy dictate. One is impressed by the competency of their designers and constructors of such plants. There can be no doubt that the ready and convenient supply of electric power available to industrial plants of all kinds, whether large or small users, has been an aid of importance to the rapid progress of Japanese industrial development as it has occurred. Considering the prices of other things, such as wages and raw materials, compared with American prices of the same things, Japanese prices for industrial power are no more favorable to the users than the prices paid for power by American industries. Some of the Japanese power companies have raised part of their capital by floating bonds in foreign countries. Certain of these are quoted among the security lists of exchanges in America and Europe. Securities, both stocks and bonds, of various of the companies are quoted on the list of the Tokyo stock exchange and trading in them is quite active.

Railroad electrification creditable

The railroads of Japan are of narrow-gage construction. They are owned and operated by the government through a Ministry of Railways. Honshu, the main island of Old Japan, is well provided with rail transportation and the other islands are sufficiently provided for their needs. The main line from shortly north of Tokyo, through Tokyo, Yokohama, Nagoya, Kyoto and Osaka, to Kobe carries a heavy passenger traffic and a good part of this line is electrified, using 1,500-volt direct current, with contact wire. Overhead construction is light and neat but substantial and confers credit on the engineers of the Railway Ministry. Early substation equipment included rotary converting machinery, but mercury-arc rectifiers have gone into the more recent locations. Japanese engineers have proved themselves competent designers of both types of machines.

Many electric interurban lines, usually of standard gage, reach out from the more important urban centers and others operate between such centers as Tokyo-Yokohama, Osaka-Nara-Kyoto, and the like. The Japanese are great travelers for people of small incomes and, like other people in eastern countries, flock to the third-class accommodations, in which the fare is very low and the accommodations crude. Railroad-operating people in Japan claim that on these third-class passengers depends the operating profit of the railroads.

Since most of the cities of Old Japan are on deep water, a preponderant part of the movement of goods, whether for domestic purposes or for international trade, is directly by water, fortified by some short hauls by carts and trucks on highways. The railroads, therefore, rely primarily on passengers to make up their traffic. The smoothness and cleanliness of electric traction is appreciated by the patrons and electrification is being extended on the main lines. Engineers of the Railway Ministry claim that the electrification proves economical. Originally the ministry bought a number of American and European electric locomotives along with locomotives of Japanese make, giving the Japanese and the foreign makers some latitude in the designs of engines planned to meet the ministry's operating specifications. As experience has been secured, specific equipment specifications have been drawn up and electrical parts for locomotives intended for a particular service are interchangeable whatever manufacturer produces the parts. The more recent locomotives have all been of Japanese make, and they seem to be competent to meet the operating needs in an excellent manner.

Communication capital cramped

The telegraph and telephone systems of Japan also are owned and operated by the government, in this case through the intervention of a Ministry of Communications. Telegraph service is good and relatively cheap. Telegrams in English, or other languages using the Roman alphabet, may be transmitted by the usual dot and dash code, but this plan fails for the transmission of the Japanese written language, which is in Chinese "characters," and a special expedient is used as in China and other countries using Chinese characters for the major part or whole of their written language. Telephone service is quite widely used in Japan and would be more used could the ministry provide a sufficient capital

amount to extend the permanent plant to fulfill all demands. As the situation stands, there is quite a waiting list of would-be subscribers in Tokyo and perhaps in other cities. A subscriber in Tokyo who gives up his telephone may secure an appreciable amount of money by selling his "number" to a successor. Apparently there is a recognized brokerage business in telephone numbers, and at one time the price that could be obtained for a number was quite high. However, the ministry now is endeavoring more adequately to meet the needs for telephone plant, and this seems to have given the manufacturers of telephone equipment a sense of optimism regarding business.

Self-sufficient in appliance production

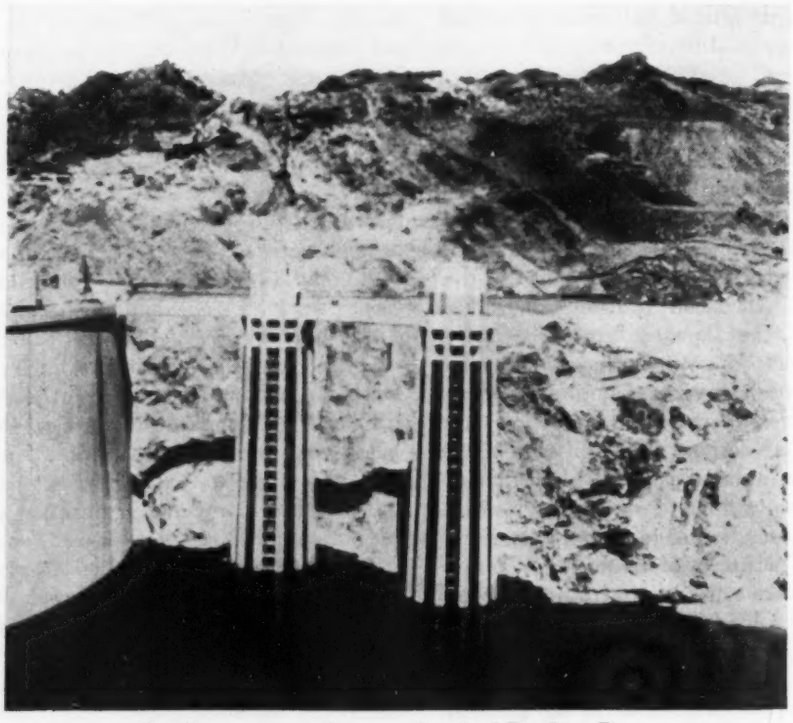
Manufacturers of radio-receiving equipment apparently have had notable prosperity. Forests of antennas are seen in many places above the groups of characteristically small Japanese houses in the outskirts of cities, and much military material in the radio field has been constructed for government use. Broadcasting is directed by the government. It seems to be well thought of by the public. The government recently has promulgated quite low rates for commercial radiotelegraph service between Japan and Japanese ships at sea, the announcement of which was received with favor.

In more general lines of electrical apparatus, such as electric lamps, luminaires, household utensils, fractional-horsepower motors, storage batteries, and so on, Japan is also substantially self-sufficient. About half a million incandescent lamps are made daily, perhaps one-third of them being made in one factory which is of modern and economical type and which possesses its own research laboratory to determine controls of production and to originate new products or processes. This factory could compete satisfactorily in the quality of its output with probably any American incandescent lamp factory of its same size, but little if any of this product gets into the export trade, most of which comes from smaller and less competent manufacturers. The incandescent lamps used in Japanese dwelling houses are mostly of low wattage and these apparently make a large proportion of Japanese usage. Electrical household equipment is not largely used, but extension of the use is being urged by the manufacturers. Established household habits and the small incomes of average Japanese householders are preventives of much demand for expensive pieces of equipment like electrical refrigerators and ranges. As automobiles are still few in Japan, the manufacture of storage batteries is of small importance compared with its status in the United States. Japan has a prospect of motor highway construction which will encourage greater use of automobiles, but the capital cost of such highways is a strong deterrent to an extensive highway construction program.

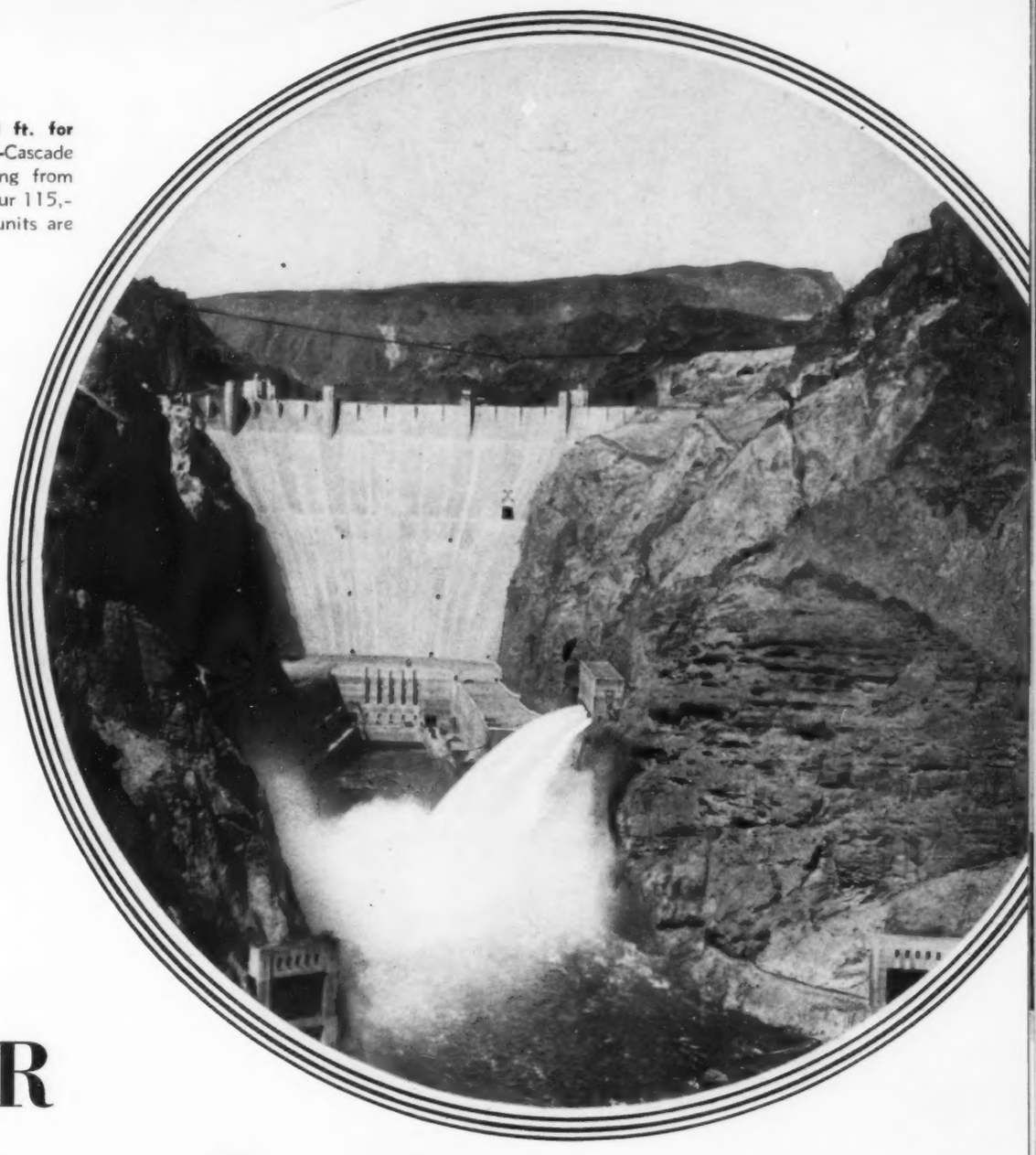
The industrialization of Japan depends on the export trade to a degree which is difficult for Americans to appreciate. Since the growth of industrial activity and the wages coming from it have clearly aided in improving the living conditions through a large part of Japan, and this result in turn is dependent on export commerce in manufactured products, the notably jingoistic attitude of Japanese citizens is explainable. The attitude may ultimately change, as it did in England and in the United States after industrialization became fully effective. However, there are other considerations that enter strongly into the Japanese situation and the ultimate outcome of the existing jingoism is problematical. In any event Japan apparently no longer can be looked upon as an important market for American electrical apparatus and is likely to become a warm competitor of ours for electrical business in other foreign markets.

Our prices are too high to compete in Japan and our production centers are too far away from that country, even if the Japanese desire for self-sufficiency were relaxed. The existing competition in the field of electrical equipment in Japan is European, and particularly German, since the German manufacturers secure advantages through the status of German money (marks) in foreign trade. For Japan proper, including Old Japan, Korea and Formosa, this foreign competition is not particularly noticeable, and the competition there felt by the electrical manufacturers is mostly intra-Japanese. In other trade, however, even where the Japanese influence is large, as in Manchukuo and China, this foreign competition still is able to make itself felt and European companies secure a good deal of electrical-equipment business, as also Americans still do (but rather haltingly) in China.

◆



Intake towers and current level of Boulder Dam



Dam impounds water at 730 ft. for 515,000 hp. of hydro power—Cascade higher than Niagara discharging from Arizona outlet valve house. Four 115,000-hp. and one 55,000-hp. units are now being installed

POWER Soon From Boulder

A.I.E.E. Conventioners Stop or Go to View Nation's Largest Power Engineering Project

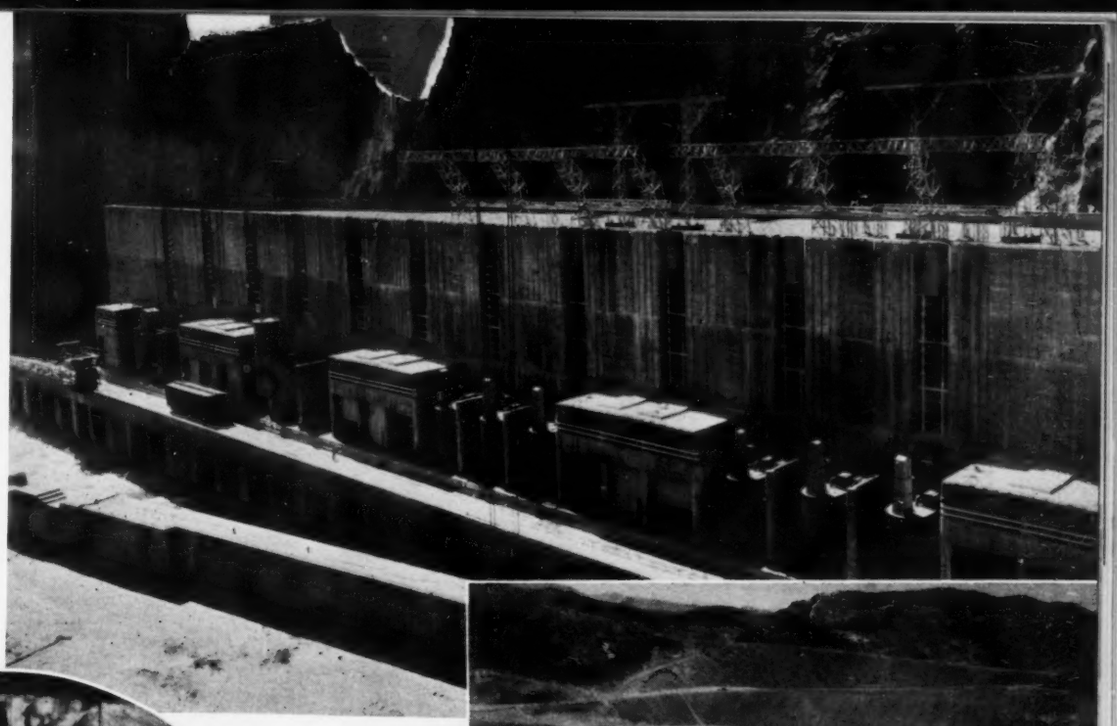
ELECTRICAL engineers took the opportunity afforded by the A.I.E.E. convention at Pasadena to visit Boulder Dam. Every one wanted to see what the government is giving us for our $165,000,000. The electrical folk saw a 495,000-kw. plant in the making at the base of the largest dam on earth. They saw the highest transmission voltage applied and the longest and fastest high-voltage switches to control its potency. With it, they saw adjuncts of bus structures, supervisory control, telephone and carrier-current relaying on a surpassing scale of magnitude.

For those who could not go we tell, by views and terse descriptions, what other more favored ones had to behold. These views are up to the minute and give a comprehensive portrayal of what American manufacturers and American engineers have contributed toward this new milestone in conservation policy.

About September 1 energy will be rolling the 266 miles into Los Angeles at 287 kv. Should a fault occur it will be chopped off by breakers of 2,500,000 kva. rating operating in three cycles.

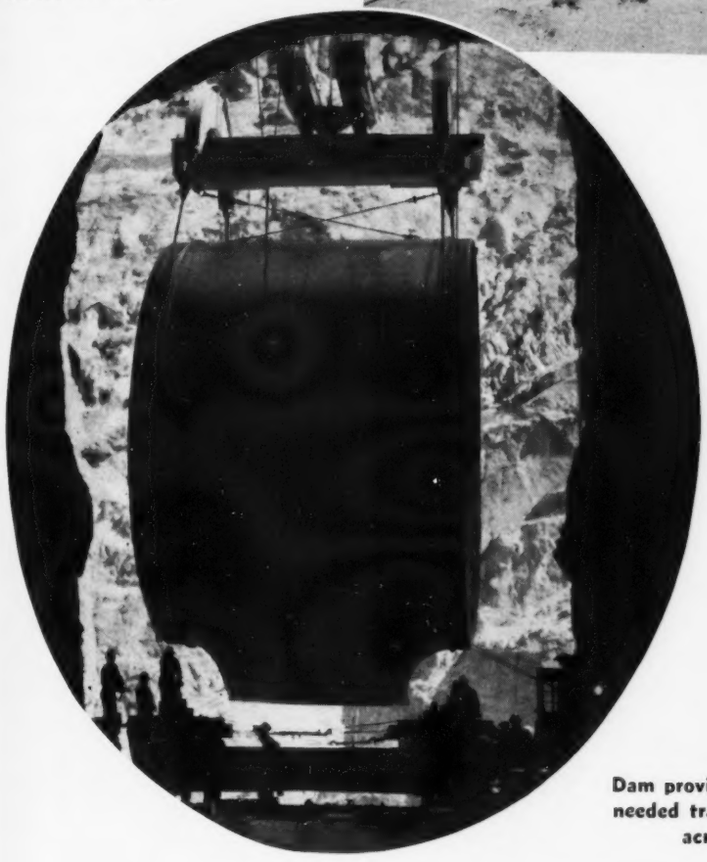
Pond has risen above base of intake towers—Spillways to discharge the excess (whenever there will be any) are provided on both the Arizona and Nevada sides of the forming lake

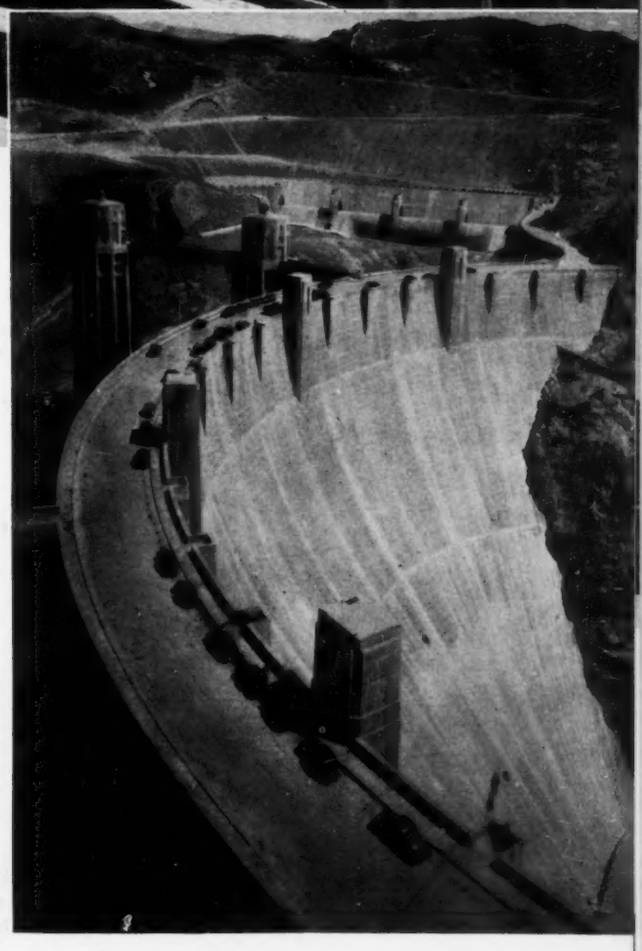
Transmission takeoff climbs cliff—Switch rack structure on Nevada wing of power house roof has overhanging members for conductor supports. Center bases for arresters. Right-hand structure for takeoff up the cliff to switch yard on its rim



Nevada power house wing well along—Switching bays and two banks of 287/16.5-kv. transformers (General Electric) each with capacity adequate for two 82,500-kva. generators in parallel. Concrete housings are for 4,000-amp., 23-kv. switchgear (Allis-Chalmers). See preceding page for roof structures

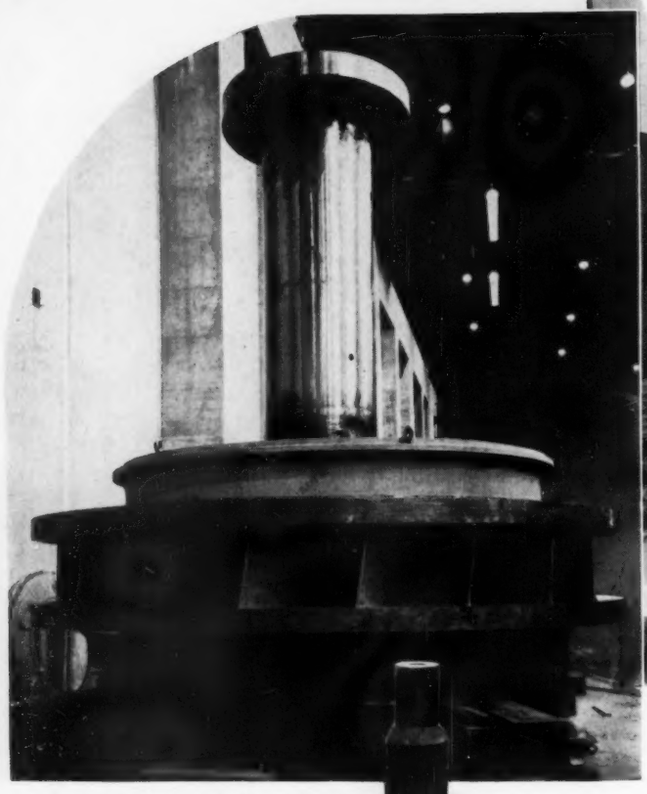
Penstock tee entering tunnel adit—Babcock & Wilcox welded the penstock in a special plant erected on the site





Dam provides much-needed traffic artery across canyon

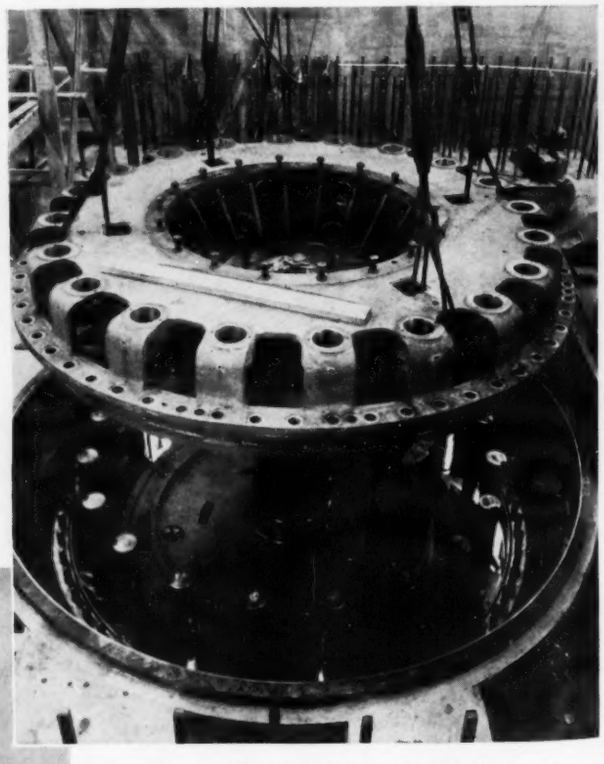
Here will be the switchyard for the Los Angeles line — Steelwork already erected for yard on rim of canyon. Lines visible at extreme right



Runner awaits installation—This is the runner for one of the Allis-Chalmers 115,000-hp. turbines. Its shaft is 38 inches in diameter

Generator gallery in throes of erection—Downstream view (May 24) in Nevada wing of power house. Stator in foreground. Three butterfly valve housings are located along the right wall

Rotor of G.E. generator assembled — Men are pygmies against this 82,500-kva. rotor

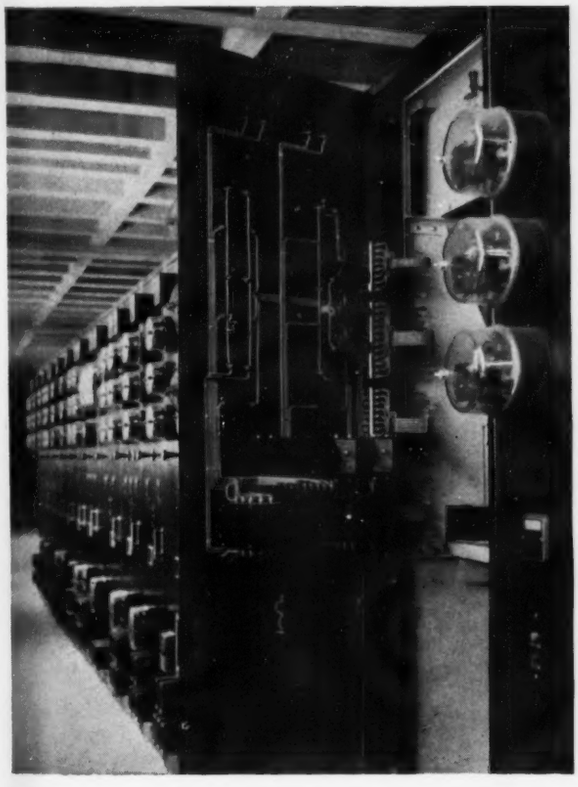


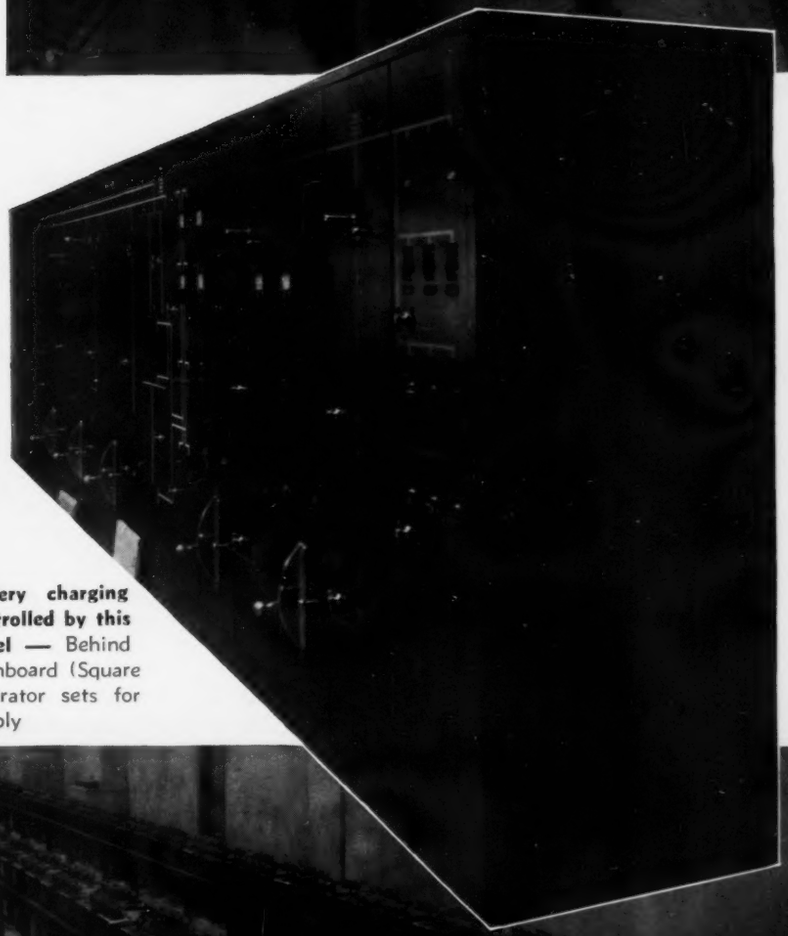
One unit goes into Arizona wing—Newport News Shipbuilding Corporation installs 55,000-hp., 40,000-kva. generating unit

Outlet valve house set in Nevada wall of canyon—At left, the valves and their manual controls, and, at right, the emergency gate operators

Reactor and breaker connected in neutral—Fault current limited to 10,000 amperes in condition where 3 main generating units are connected to bus and can feed back through 2 generators connected to their transformer tank and the 287-kv. bus. Westinghouse

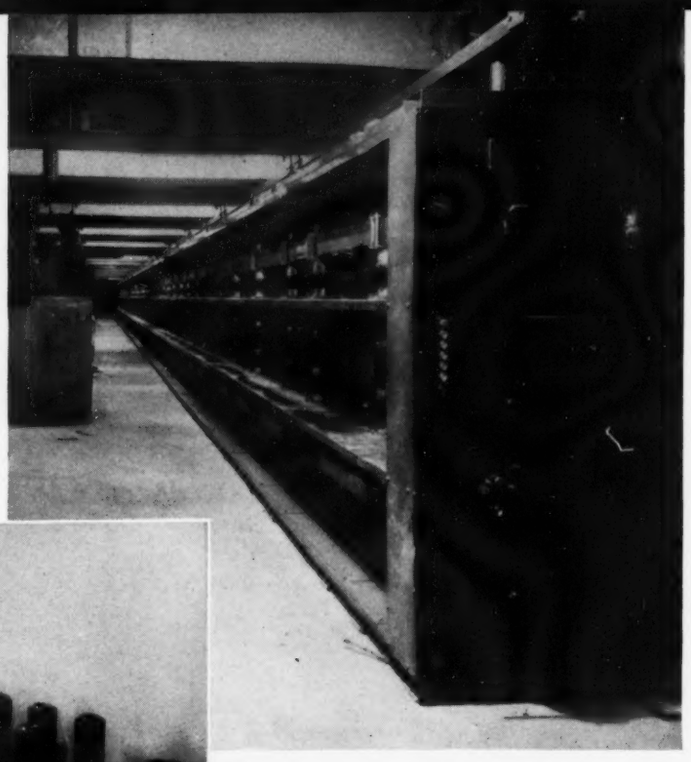
Delta Star provides station service metal-clad 2,300-volt switchgear—Located in central portion of power house





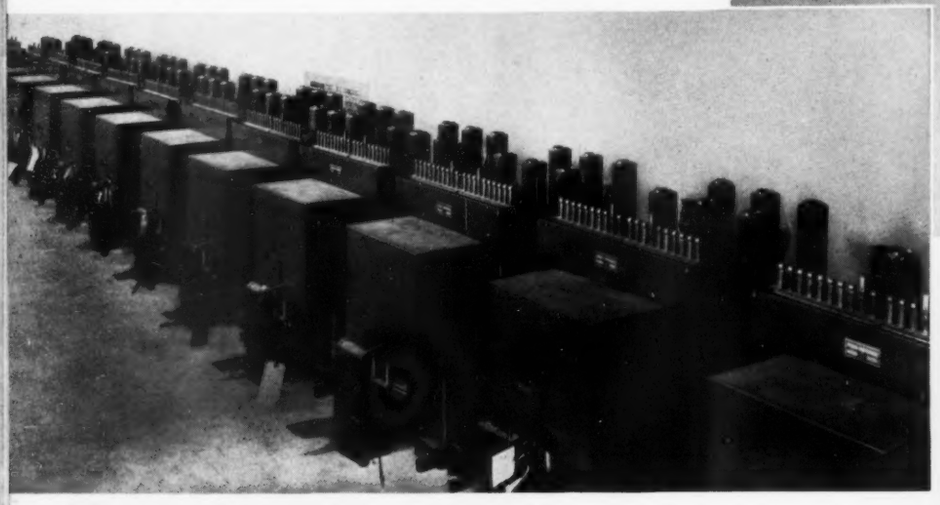
Battery charging controlled by this panel — Behind this battery control switchboard (Square D) are the motor-generator sets for charging and for d.c. supply

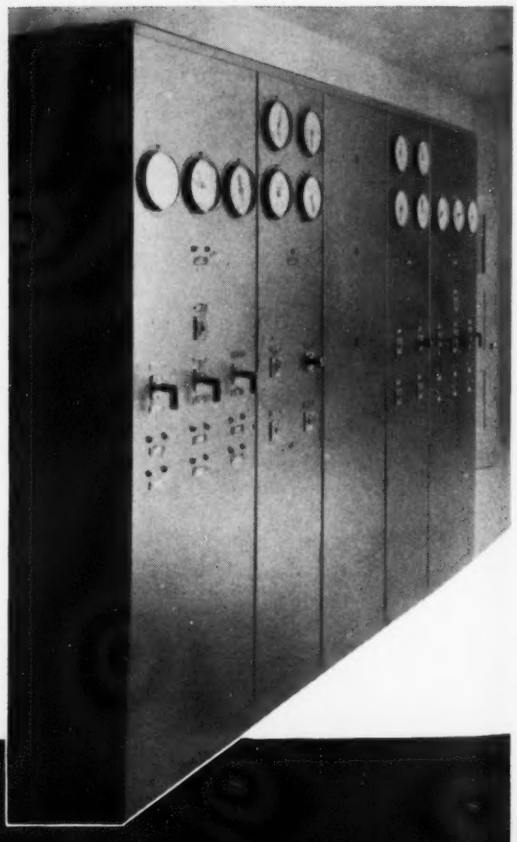
Station service d.c. from Exide batteries — Two such rooms house the 120-cell, 240-volt battery



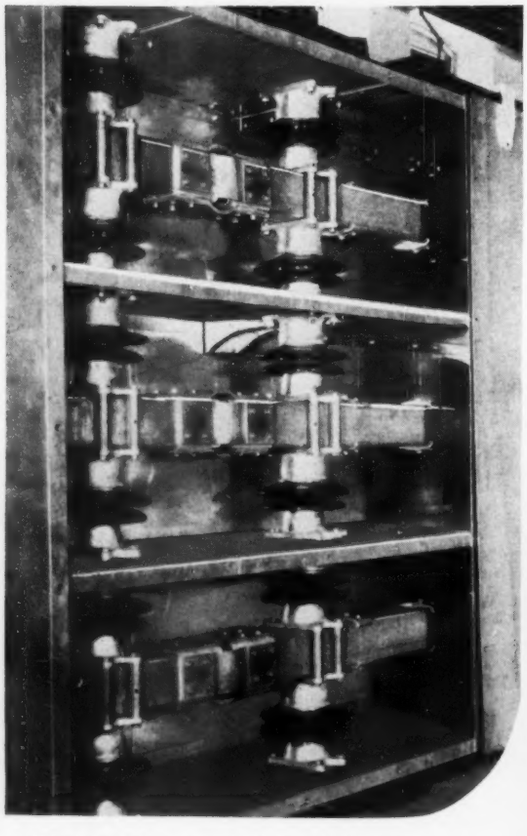
Main bus copper inclosed—At full station output, the amperage is so high that eddy currents in surrounding metal called for insulation of reinforcing iron and of copper and brass conduits

Oil-blast breakers wait patiently for installation—To go in Delta Star metal-clad station service switchgear cubicles (600 and 1,200 amp., 15 kv., 100,000 kva.)





Watermaster has separate hydraulic control board—Meters indicate positions of lower tunnel plugs, of intake tower cylinder gates, etc., on these General Electric panels

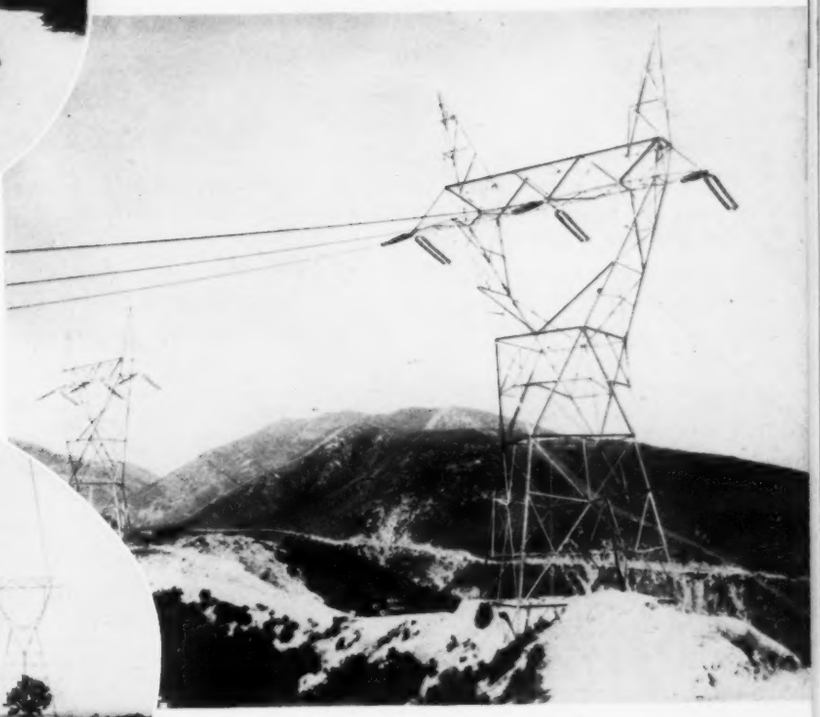


Flexible joints in I-T-E bus inclosed, 4,000-amp., 23-kv. of Anaconda copper conductor

Cable gallery provides racks for conduit and tray tiers for control cable

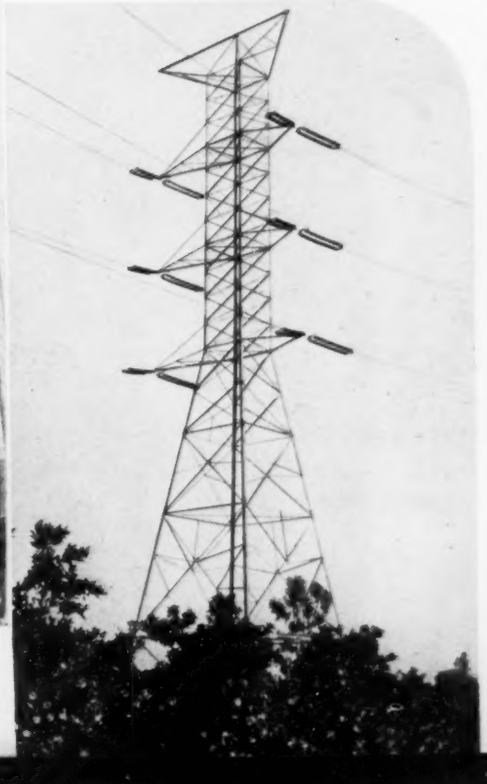
Rocky going all the way for the line builders—Cable stringing equipment trudging along for another bite

Two single circuits stretch across the desert to the movie metropolis—General Cable Corp. supplied the conductors and Ohio Brass the 287-kv. insulators

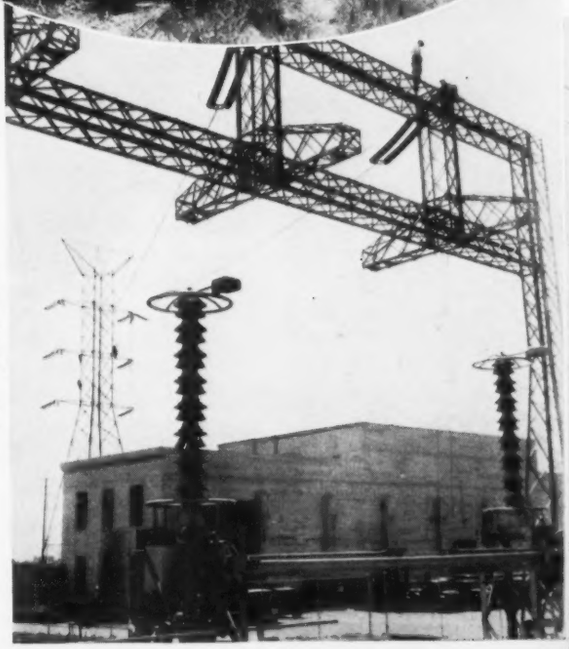


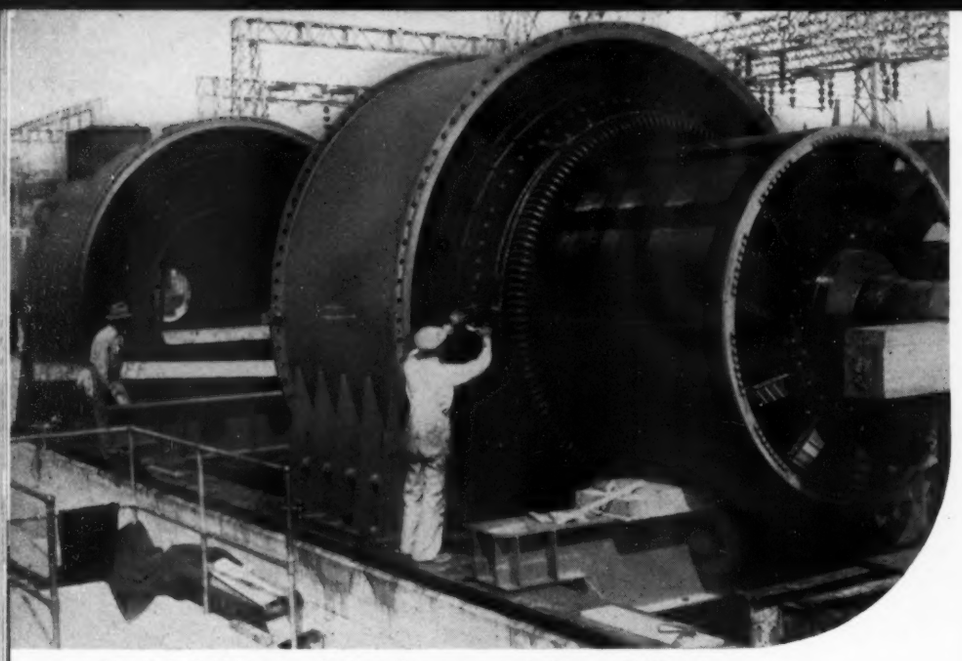
If it wasn't mountains, it was sand and cactus

Angle towers on the 287 kv. line near Los Angeles are 144 feet high

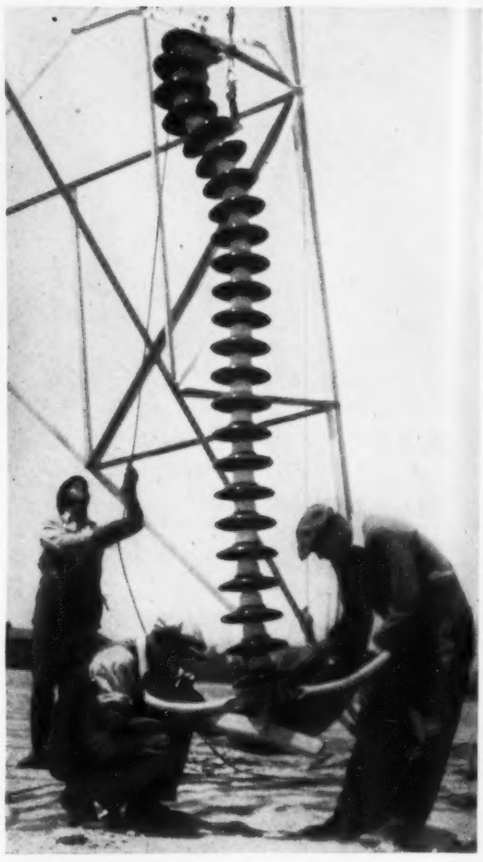


Los Angeles takes it all at Station B—This is the Los Angeles Bureau of Power & Light terminal of the 266-mile, 287-kv. lines

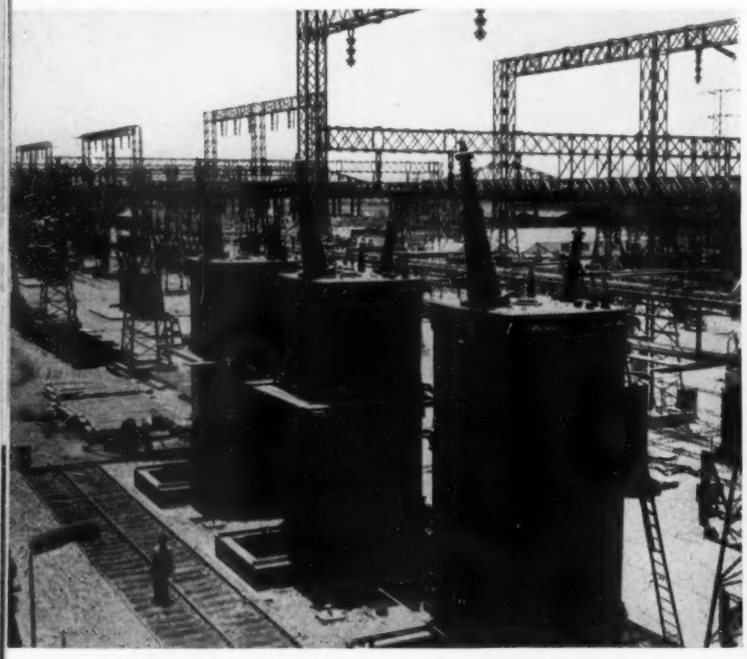




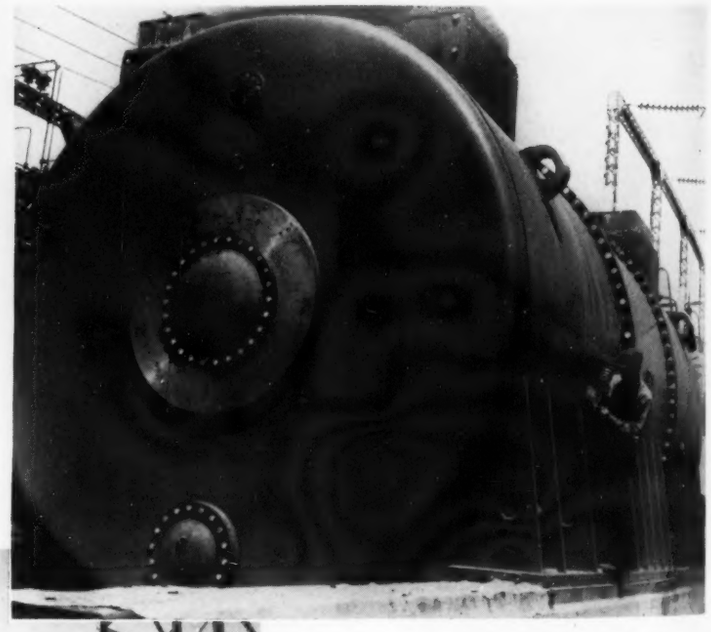
One G.E. hydrogen-cooled condenser on each line at California receiving end—13.2-kv. synchronous units are rated 50,000 kva. leading, 26,000 kva. lagging



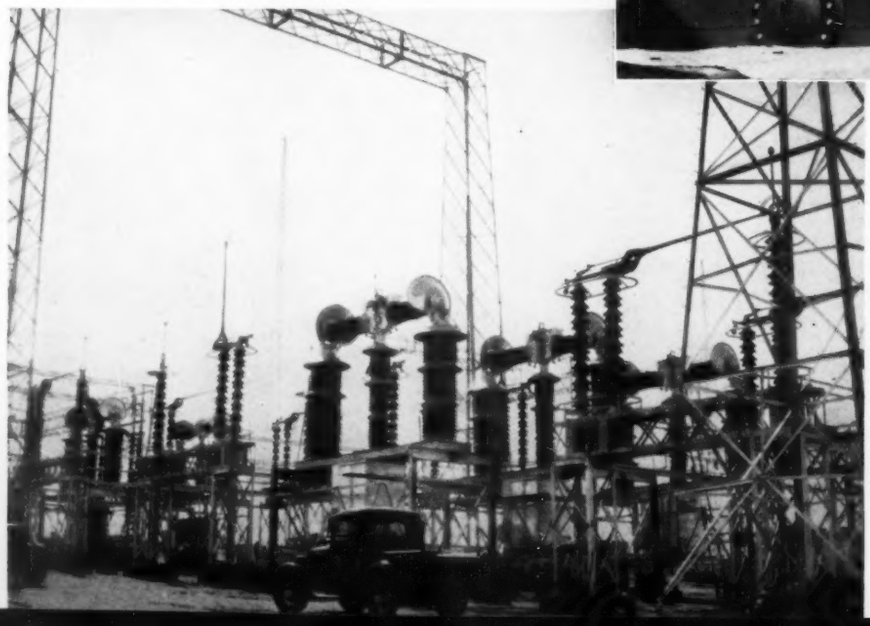
Eleven-foot insulator string starts topside—Assembly of 24 disks terminates in special type of arcing horn and cable clamp developed for the type HH cable used as a conductor



Westinghouse transformers receive the delivery at Los Angeles—Six 186-ton units will transform from 287 to 132 kv. Each will handle the miximum capacity of 80,000 kva. for two hours using blowers



Synchronous condenser as it looks housed outdoors



New type General Electric breakers installed at Victorville switching station—Operate in 3 cycles at 287 kv. Rated at 2,500,000 kva. The adjacent disconnects, of equally novel design, are Delta Star

Hydraulic Loss Tests

Tunnel and Penstock Tests Add to the Knowledge of Entrance and Diversion Losses — Balanced Operation of Turbines May Increase Over-all Plant Efficiency

By ELLERY R. FOSDICK
Assistant Engineer Department of Public Service, State of Washington.

TO OBTAIN further engineering data on the losses in long flow lines, the Washington Water Power Company decided to conduct a series of hydraulic tests on the tunnel and penstocks of its Chelan hydro-electric plant. The purpose of the investigation was to determine the total over-all loss in the flow line to permit accurate computation of turbine water consumption. It was anticipated that the study would develop additional engineering data regarding losses in concrete and steel-lined pipes, the losses in large wye sections and possibly the magnitude of the diversion losses in large pipe bends.

Chelan plant is located near the confluence of the Chelan and Columbia Rivers and obtains its water through a 2½-mile flow line from Lake Chelan. The elevation of Lake Chelan, which is about 400 ft. above the Columbia River, is regulated by a dam across its outlet, the Chelan River, about one-half mile from the lake.

Intake to the flow line, which is of the Johnson-Wahlman draft-distributor type, is incorporated with the dam. A general profile view of the intake, dam, flow line, surge tank, penstock and power house is shown in Fig. 1.

From the intake the water enters a pressure tunnel 14 ft. in diameter made of concrete that was cast around steel forms to produce a smooth interior finish. Water flows through this for a distance of 10,578 ft. down a 0.312 per cent grade. At this point, where the grade increases to 35 per cent, the tunnel lining is changed from concrete to a double-butt, strap-riveted steel shell. The tunnel extends 397.79 ft. along the 35 per cent grade, where a 14-ft. steel-lined pipe rises vertically to the surge tank. Adjoining sections of the steel lining were fastened together with square-edged butt straps and button-head rivets.

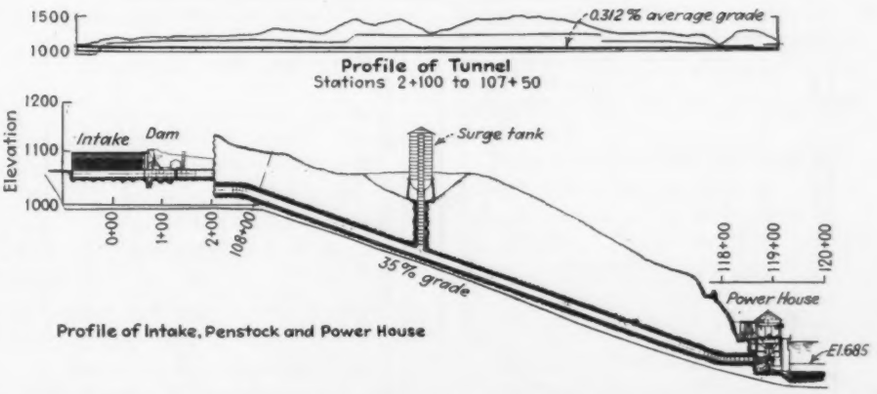


Fig. 1—Chelan hydro-electric development tested for tunnel and penstock losses

At the time these tests were run the interior surface of the steel lining had become somewhat rough, as, at the time it was put into service, it had been protected with only the customary factory coat of red lead paint. While the interior has since been cleaned and repainted with bituminous enamel, no further tests have been conducted to determine the effect upon the losses.

The penstock, from the surge tank riser to the wye branch, a distance of 604 ft., continues at a 35 per cent grade, converging in this distance from a diameter of 14 ft. to 12.50 ft. It divides in the wye branch into two 8.83-ft. penstock pipes, which also have double-butt, strap-riveted steel lining, as shown in Fig. 2.

The two penstock branches diverge from each other to a point 40 ft. below the wye, where they bend in toward each other through an angle of 29 deg. 13 ft. 26 in., so that they lie in a horizontal plane parallel to each other. From here they enter the power house, each one connecting to a Johnson valve, which in turn is connected through a reducing section to the turbine scroll case, the total length of each penstock branch measuring 138 ft.

Each of the turbines is rated at 34,600 hp. and consumes approximately 1,100 cu.ft. per second of water when the turbine gates are wide open. The discharge from the turbines flows into the tailrace in the Chelan River through a spreading draft tube.

In order to obtain data covering all conditions of balanced and unbalanced flows through the two units, the distribution of load between the two units for the test runs was varied in the following manner:

1. One unit with the turbine gates wide open, the other increasing its load by steps until it was wide open.
2. The two units with balanced loads decreasing the loads by steps to zero.
3. One unit only increasing its load by steps until wide open.

In order to determine the losses that occurred in various sections of the flow line equipment was installed for observing the pressure heads in the vent which is located at the beginning of the tunnel just below the intake; in

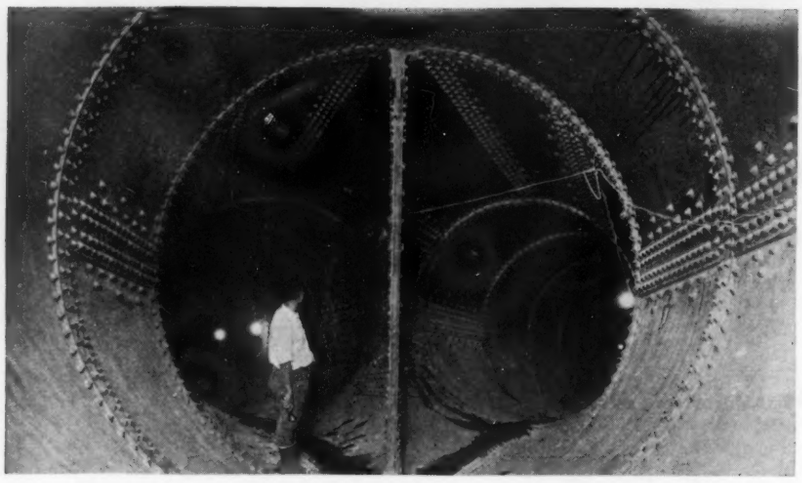


Fig. 2—Wye introduces larger losses than commonly assumed

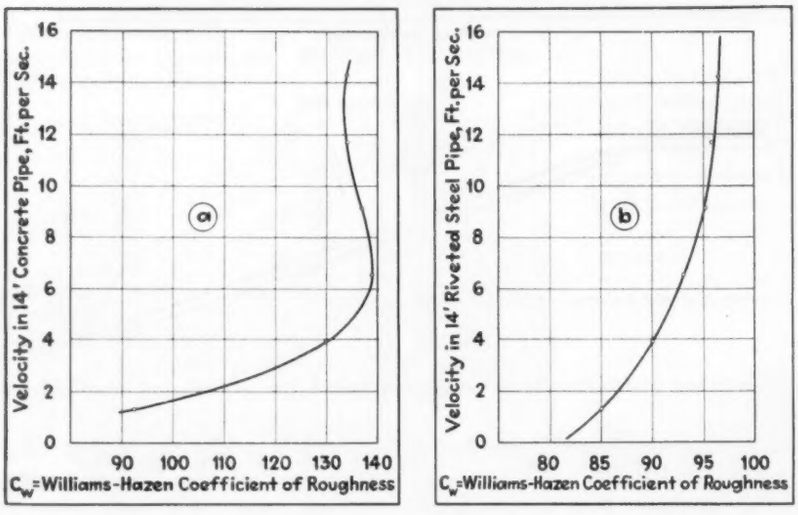


Fig. 3a—Variation of the roughness coefficient C_w of the Williams-Hazen formula with varying velocity in a concrete pressure tunnel. Fig. 3b—Variation of the same coefficient with velocity in the steel penstock between the surge tank and the wye

each of two adits lying between the vent and the surge tank; at the surge tank, and at each of the reducing sections just above the turbine scroll cases. In addition, the elevations of the forebay and the tailrace were recorded. High-speed water level recorders which had been rebuilt to give a chart speed of 0.1 in. per minute were used for recording these data at the forebay and the vent. Mercury manometers connected to piezometers in the tunnel at each of the adits, in the surge tank riser and in the reducing sections were used for recording the pressure heads at these places and a staff gage was used for reading the elevation of the tailrace.

Because of the extremely high head on the reducing sections it was necessary to use mercury pots with the manometers which consisted of a single riser instead of the conventional U-tube. Readings were made by observers from each of the manometers and from the staff gage in the tailrace after stable conditions of flow for each test run had been reached in the conduit at predetermined intervals. Throughout the tests the governors were manually controlled to prevent governor hunting and the resulting variation in flow.

As the result of a seiche which disturbed the elevation of Chelan Lake while these tests were being run it was necessary to correct all of the observations, except those in the tailrace, for this disturbance. For the purpose of comparison with the forebay and tailrace elevations, the pressure heads at all other observation points were converted into total energy heads by adding thereto the velocity heads. For the purpose of computing the latter the turbine water consumption at different loads was determined from data that had previously been computed as the result of Gibson tests.

With a maximum flow of 2,200 cu.ft. per second the total loss through the trash racks and intake was found to be approximately 1.7 ft. and the total loss in the flow line between the vent and the surge tank was approximately 25 ft. The equation for the losses through the trash racks and the intake was found to be $Q^2 = 280\ H_f$.

Concrete formula verified

Losses for that portion of the tunnel lined with concrete were found to conform rather closely with the losses that would be computed from the Williams-Hazen formula by using the commonly accepted value of 134 for C. The variance in this value of C for different velocities in the tunnel is shown in Fig. 3a, from which it will be seen that, with the exception of extremely low velocities, the value of C lies between 130 and 139. The corresponding variation of n, which is Kutter's coefficient of roughness, is shown in Fig. 4.

Loss of head in each of the penstock branches from the piezometer connections in each converging section to a point 78 ft. upstream, which is just above the bend, had previously been determined from the Gibson tests. This loss consisted of frictional resistance and diversion losses in the bend combined. The term diversion loss as used here refers to the loss of head that occurs in flowing water when the stream is diverted laterally from a straight path.

The diversion losses in penstock branch No. 1 may be expressed by the equation $Q_1^{2.20} = 330\ H\alpha$ and in penstock branch No. 2 $Q_2^{2.20} = 210\ H\alpha$.

The fact that the diversion losses in these two branches are different is probably a result of the unsymmetrical arrangement of the turbine scroll case spirals with respect to the penstock branches; that is, each of the turbine scroll case spirals rotates in the same direction, while the bends in the penstock branches are in opposite directions with reference thereto.

Departure from conventional coefficients

Losses in the steel-lined penstock between the surge tank and the wye were found to vary with the 1.75 exponent of the mean velocity instead of with the 1.852 power, as is the case with the Williams-Hazen formula.

These losses were determined in a way which will be subsequently described and are shown on Fig. 5. If the Williams-Hazen formula is used to compute these losses the coefficient of roughness which must be used will vary between about 82 for very low velocities of flow and 96.5 for high velocities of flow, as is shown in Fig. 3b. The corresponding values of Kutter's coefficient n are shown in Fig. 4.

Losses from the surge tank to either turbine scroll case were observed, as explained in the first part of this paper. The penstock between these points was beneath the surface of the ground in solid rock and consequently it was impossible to make any additional piezometer connections that might have been desirable in order to determine directly the losses that occurred in the wye branch. As a result it was necessary to determine these losses in a more or less indirect manner.

The first step in this analysis was to compute the losses in each penstock branch from the turbine scroll case to a point just below the wye branch. The losses in each of the penstock branches from the scroll case to a point 78 ft. up toward the wye had previously been determined at the time the Gibson tests were run. It was therefore an easy matter to determine these losses for the entire penstock branch by separating the frictional resistance from the diversion losses that occurred in the lower penstock bends and increasing the frictional resistance in proportion to the length of the penstock branch.

The total loss in each penstock branch was then removed from the total observed losses from the surge tank to the turbine scroll cases, leaving the losses from the surge tank to a point just below the wye branch. This is the data which has been plotted in Fig. 5.

Position of the curve for losses resulting from linear friction in the penstock between the surge tank and the wye was determined in Fig. 5 by a geometrical process utilizing the values of eddy and diversion losses for different flows.

Various losses segregated

Losses occurring in the penstock from the surge tank through the wye were found to be composed of linear friction losses in the section of penstock from the surge tank to the wye, eddy losses near the tie plate in the wye, and diversion losses resulting from the diversion of water into the penstock branches. The relation of these various losses to each other and their variance with the flow in the penstock is shown in Fig. 5. From this graphical analysis it will be seen that with equal flows passing through the two penstock branches there are no eddy losses H_E in the wye branch. However, diversion losses, $H\alpha$, exist in the bends of the penstock branches that take off from the wye for all conditions of flow. Thus, it will be seen that with one unit shut down and the other unit running, the losses through the wye branch to the unit that is running will consist of eddy losses and diversion losses, while, on the other hand, if the two units are taking equal quantities of water the losses to both of them through the wye branch will consist only of diversion losses. To study further the eddy and diversion losses in the wye branch and to determine their relationship to the flow in the penstock they have been plotted in Fig. 6 (page 106) and equations for the curves have been derived and are shown thereon in terms of the quantity of water flowing. From this curve it will be seen that the eddy losses may be expressed by the equation $Q^{3.85} = 12.5 \times 10^3 H_E$.

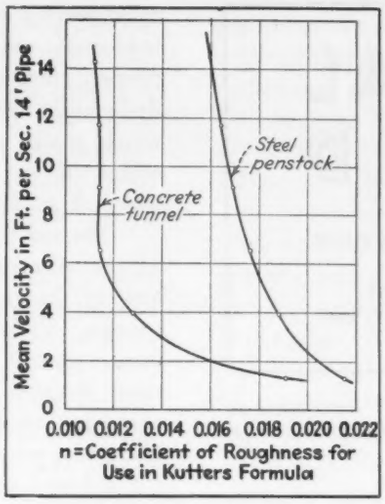


Fig. 4—Variation of Kutter's coefficient of roughness n with velocity in concrete and steel pipes

Diversion losses in wye branch No. 1 can be expressed by the equation $Q_1^{1.75} = 18.5 H\alpha$.

The symbol Q as used in these equations represents the total flow in the penstock above the wye; the symbols Q_1 and Q_2 represent the flows in penstock branches Nos. 1 and 2, respectively.

Total diversion and eddy loss in wye branch No. 1 may be expressed by the equation $H\alpha + H_E = 0.054 Q_1^{1.75} + [0.0103 Q^2 - 0.0415 Q_2^2]\ [0.008 (Q_1 - Q_2)^{1.85}]$. Similarly, the total loss in No. 2 branch may be written $H\alpha + H_E = 0.054 Q_2^{1.75} + [0.0103 Q^2 - 0.0415\, Q_2^2]\ [0.008\, (Q_1 - Q_2)^{1.85}]$. These equations can be used only when the flow is greater through No. 1 penstock branch than it is through No. 2 penstock branch. Whenever the flow is greater through No. 2 branch than through No. 1 branch it is necessary to interchange Q_1 and Q_2 in that part of the equation dealing with eddy losses which is on the right-hand side of the plus sign.

[*Continued on page 106*]

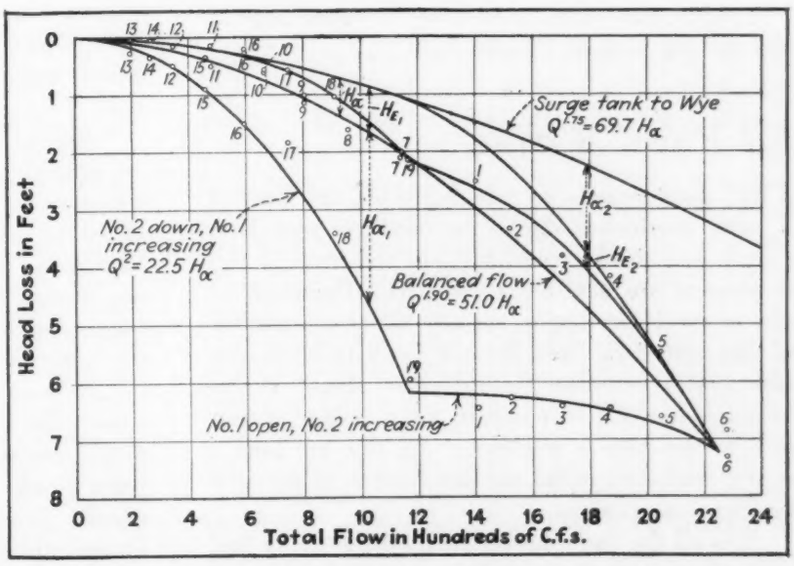


Fig. 5—Loss of head in feet in the Chelan plant tunnel and penstock from the surge tank through both wye branches

ELECTRICAL WORLD

L. W. W. MORROW • EDITOR

PUBLISHED EVERY SATURDAY BY
McGRAW-HILL PUBLISHING COMPANY, INC.

VOLUME 106 ESTABLISHED 1874 NUMBER 29

JULY 18, 1936

•

What Power Policy?

A STRANGE and uncertain situation exists in the federal power projects. There is no common policy and all is at sea. Out at Boulder power is sold as falling water to private and municipal utilities under no restrictions. Down in the T.V.A. the policy is straight-out destructive competition with existing utilities despite their offer to buy the power and distribute it. Out at the Loup project they are trying to peddle power—all dump—to utilities at about 4.5 mills. At Bonneville and Grand Coulee no one knows what policy is to be followed. All is inconsistency and uncertainty.

Why? Our guess is that no one can agree in Washington on a policy. Senator Norris is an ardent government ownership advocate. Others believe in private ownership. Many fear the legal threats in the offing, and still others are merely mouthing vindictive threats. We have the spectacle of nearly a billion dollars of taxpayers' money being spent without any basis in economics and without any thought-out policy on power supply. And yet some people say private enterprise is inefficient!

Pressure now exists to have the President issue an order on each project. Yardsticks?

•

Aid Rural Wiring

THE developments in bringing down the costs of rural distribution during the last three years have in many cases been appreciable, and the fruits of that development are now being gathered. Thousands of miles of rural distribution are now under construction and line costs have been brought down to levels that make service extension possible now almost always where a source of power supply and a density of four farms to the mile is available. All this has been a major contribution in the ultimate solution of the rural electrification problem.

It is all the more disheartening, therefore, to find in so many cases the potentially splendid effects of rural service extension nullified by inadequate wiring, inadequate outlets, poor fixtures, total lack of, or improper, control switches; in short, by hit-or-miss and fly-by-night methods in carrying out that part of the job which really determines whether electric service becomes the joy and boon it can be or whether it passes into just another painful experience.

The sad part of the whole business is that farmers who get electric service are generally so eager to know and do the right thing. But eagerness alone is not enough. To a shortsighted wiring contractor another farm customer represents just another job, and where rural electrification is going on intensively jobs are numerous, business is booming. This state of affairs leads, too, generally to the situation where, as likely as not, a drop cord and open lamp will be installed as the principal and only light source in the kitchen.

Another job, then, for the utilities? Yes, of course. But another opportunity too! An opportunity to tell the prospective farm customer in his own language all he needs to know about services, their protection and grounding; to tell about wiring layouts, mains and outlets and wiring devices; to tell about various classes of materials that can be used and their respective applications; to discuss lighting and recommend fixtures; to give information on appliances; and, in short, an opportunity to be of service and to teach how to make the most of electric service. Such an opportunity no utility engaged in rural expansion can afford to let pass by idly.

•

Broadened Support for the Heating Salesman

DAY BY DAY the commercial heating salesman of the utility company packs his kit and hies himself out to his territory pushing his one-man-power to as many likely spots as possible in an effort to report more and more new heating kilowatts on his daily report. There's a trick heating job here and an unusual job there, a lukewarm prospect out near the city limits and a new inquiry-coupon-clipper down near the bus station. Four calls, and the morning has gone.

Has the time come for a periodical analysis of selling methods on the firing line? Is it possible that even a cursory objective study would result in improvements in selling procedures which would change the trick heating job into a normal application of electric heating, change the unusual job into an ordinary normal usage, change the lukewarm prospect into a user and the inquiry-coupon-clipper into a customer?

In those sales groups where this topic is being discussed, the assistance which has been rendered the utility salesman by booklets, pamphlets, folders and pages of advertising is readily and gratefully acknowledged. Time has proved these to be the ideal media for smoothing the path of the salesman and dissolving sales barriers before he arrives at the sales arena.

But a new demand is becoming noticeable in the field. No longer does the salesman want only advertising which has made his prospect feel that electric heating is reserved only for the industrial élite. He is now beginning to ask support from advertising that encourages electric heating for all purposes, for the common everyday needs of industry, not alone for the unusual heating wrinkle.

Broaden the field of application, the salesman adds, and broaden the sales appeal. Point a message to the shop foreman whose output is improved when electric heating enters his little kingdom. Unroll a barrage of ideas before the plant eelctrician who, once he is familiar with the advantages of electric heating, will look around for other applications which will simplify his duties and at the same time make him more useful to his outfit. Dangle some dollars and cents advantages of electric heating before the eyes of the small-plant bookkeepers and office managers so they may inaugurate economies. Then, when the heating salesman packs his kit and hies himself out to his territory, eager to list added heating kilowatts on his daily report, he meets an acceptance of electric heating as an every-day working aid, not as a Zulu islander reserved for freak jobs, and somewhere in the prospect's organization is an employee disposed to help make the sale.

•

The Problem of Insulation

THERE is one element of all types of electrical equipment which is still so imperfectly known that close engineering design is not only impossible, but for which such large factors of safety must be allowed as to offer substantial opportunities for improvement, economies and reduced costs. This uncertain element is the insulation.

Yet for its proper and continuous functioning every electric circuit depends essentially upon its insulation. This statement goes far beyond the mere prevention of short circuit and shock, although these are of first importance in high power circuits in which fire, destruction and danger to life constitute major hazards. This first insulating function in fact constitutes merely a basic principle beyond which, however, wide requirements of special problems as related to specific types of service must be met. Thus in the case of high power circuits, dielectric loss as related to temperature rise and current rating, dielectric constant as related to permissible capacitance, chemical properties as related to stability, and physical properties as related to the exigencies of manufacture, transportation, installation and operation are only brief statements of the numerous elements which require control, improvement and extension through scientific research. The open air high-voltage transmission line presents a similar variety of problem. In low-voltage communication circuits, with their wider and higher frequency ranges, the problem of physical separation for the mere insulation function is quite subordinated to the influence of attenuation and distortion on clarity of signal and of speech, this influence being dependent upon the electrical properties of the dielectric materials constituting the insulation. In the range of still higher frequencies, such as in carrier circuits and in the equipment for radio transmission, still further special relationships arise between performance characteristics and dielectric properties. Let it be remembered also that such attainment as may be possible of the ideal relationships between insulating materials and specific requirements must usually be accomplished under the conditions of quantity production and commercial manufacturing methods.

The situation calls for continued and intensive research. Much has already been accomplished. The origin and variations of dielectric constant in both pure and complex materials have been widely studied. Our knowledge of the nature and magnitude of dielectric loss has also been widely extended. New materials have been developed for meeting the special needs of high-frequency circuits. Precision research has indeed gone far in simplifying the design of insulation in which electric stresses and temperature ranges have low values. For high-voltage and high-power equipment, however, the problem is still wide open and resolves itself into two broad questions. First, the physical and chemical instability of most available insulating materials under the combined influence of high electric stress and temperature elevation, and, second, the conservation of the original properties of the materials through the normal processes of manufacture, transportation and installation. Research of the type required is costly; its volume in the recent lean years has been greatly reduced; it is to be hoped that the steadily increasing demand for electric power will soon again result in renewed appropriations for insulation research.

•

Ostrich Feathers

STRANGE contrasts confront the inquiring reporter as he browses around. Thus in an industrial establishments he meets a metallurgist who had perfected a new process, after painstaking research. At one stage, he hesitated because he feared he would not be able to procure generators and conductors massive enough to handle the prodigious currents he was going to need to make his process commercial. Amperes galore were no obstacle here in the end.

Not far away, the I.R. meets a utility manager and pops the question about residential load building. "Well, what's the good of spending $3 to boost the annual revenue from $35 to $40 and then have to reduce the rate to $32. That looks like losing at both ends."

At one spot, plumes and a gay festive outlook backed by pride in product and expansive accomplishment. At another spot, just a head hiding in the sand of the desert. Must there be such contrasts of gloom and fervor?

Less Thunder on the Left

FEDERAL pressure against holding companies seems fairly certain to continue, probably by many routes, almost surely by "double" taxation, for some time to come. But the electrical industry as a whole seems due for a breathing spell, so far as muckraking by Senate, House and departmental and bureaucratic investigations is concerned, until after election. And after election things will be different.

This seems almost certainly true whether Roosevelt or Landon is elected in November. If Roosevelt should be defeated it is rather obvious. But even if Roosevelt is elected he will no longer have anything like the measure of domination of Congress which he has exercised in his first four years. It would be unthinkable, for instance, that he would be able to force through the so-called compromise death sentence for holding companies were such a problem to confront the Congress which will convene in January, and which will have been elected this November.

One of these reasons is that the next House of Representatives will almost surely be close. If the Democrats control it, their majority will not be more than 50, in all probability. If the Republicans should happen to win control, despite the re-election of Roosevelt, their majority will probably not exceed 20.

This statement, which may be surprising to many readers, is based on reports from very competent persons in each of the several hundred doubtful districts of this country and represents the *present* prospects, without any allowance, of course, for trends which may or may not develop between now and election day. Nor for popular reactions to events which may transpire before November 3.

THE other reason is that, after this election, and waving aside all talk about a Fascist coup, or a Roosevelt dictatorship, the reasonable expectancy will be that Mr. Roosevent will never again be a candidate. Individual Democrats who cherish ambitions will be thinking of how best to call the attention of the country to their political virtues. They will not be worrying nearly so much about what the White House may think of them. They will believe that never again will they have to run on the same ticket with him. And, furthermore, to inject just one sordid thought, the federal patronage will have been, for the most part, distributed.

So the boys and girls on Capitol Hill are going to be independent. "Stand by the President" will have lost its magic as a slogan. "Vote in your own interests," always predominant, will not necessarily mean voting as the White House wishes, as so vast a majority in House and Senate, especially the House, have thought up to now.

Last year these national legislators discovered that a great many of their constituents were not in favor of the death sentence for public utility holding companies. Despite the revelation of stupidity in the letter writing and telegraphing campaign, these legislators found out to their own satisfaction that they had a lot of voters in their own districts and states who were interested in the electric industry.

The President won his battle, but he had to exert every ounce of pressure he could bring to bear to win it, and he won it by the narrowest of margins, and even then only after rather befuddling his opponents in the so-called compromise.

Since then the Senators and Representatives have not been entirely out of touch with their constituents. They have found out a good many things. They have found out, among other things, that a very large number of the persons in their districts and states who wrote or telegraphed them in protest against the holding company bill were and still are vitally interested in electric operating companies. They have found out that some of them are not disturbed about the holding company phase, but that naerly all of them would be very much annoyed if anything were done which would interfere with the flow of dividends from their operating companies.

OBVIOUSLY, some Senators and some Representatives have discovered that the number of their constituents who are in this class is large, while others have found the number small. Some will give due consideration to this fraction of the voters who keep them in office when anything affecting their interests comes up for consideration. Others will not. The important point is that, with a close House, a very small bloc can turn the tide in any important vote.

As a matter of fact, William Lemke—Father Coughlin's candidate for President—is figuring on this same situation, though from a different angle. Lemke and Coughlin really believe they will hold the balance of power in the next House as between the Democrats and Republicans. Which is not half as crazy as it sounds.

All of this, assuming Roosevelt's re-election, which may happen, though this writer doubts it very strongly, spells some respite from new attacks for the electric industry, but does not promise much for the holding companies. Of course the continuance of government operation, government loans for construction of municipal electric plants, etc., will continue *so long as present appropriations hold good.*

But the new House will not be so liberal in voting appropriations for such loans. The Republicans will have either a small majority, or a minority so strong that a mere scattering of Democratic defections would give them control. And the Republicans have their own ideas about how relief money should be spent. And about government competition with private industry. By that time they will have been much more committed as a result of many speeches yet to be made. There will also be the item of self-interest in connection with their electric security holding constituents already mentioned.

Muck-raking investigation will be curbed by the same sort of thing. Not entirely stifled. Hugo Black—the famous private telegram reader—will still be in the Senate. The Democrats will be in control of the Senate during the next four years regardless of intervening elections. But even here there is a soft pedal. Mr. Black had some difficulty getting an appropriation from the House for the last lap of his investigating committee. He will have

—By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

plenty more next time if he shows a continuing desire to hound this industry.

The prospect is not so cheerful for the holding company phase. In the first place, it is going to be very difficult indeed to repeal any taxes already imposed. The answer to this is that next year more taxes, rather than less, will be needed. If the country should demonstrate its approval of Roosevelt spending by re-electing him a great deal more.

NOW let's look at this House of Representatives situation, as analyzed from reports from all the doubtful districts, and see what the prospect is for the next House being very close, and, possibly, slightly Republican, even in the event of Roosevelt's re-election.

It will be remembered that the present House, which one hopes will never meet again, was elected in November, 1934, the high tide of New Deal and Rooseveltian popularity.

Forty-six seats in the House are now held by Democrats from districts which, according to these reports, are almost sure to go Republican this November, no matter what else happens. Sixty-five seats in addition now held by Democrats are listed as being fifty-fifty propositions as of today. Which means that any strengthening of the Republican situation will carry them into the Republican column.

Fifty more seats are listed as being "slightly Democratic" in the present leanings, which means that any considerable turning of the tide toward the G.O.P. would give the Republican candidates in those districts the edge.

Just to pick out a few interesting spots in the list, California has seven districts now held by Democrats of this fifty-fifty class. Connecticut has one leaning Republican and three in the fifty-fifty class. Illinois has six leaning Republican, seven even and three in the possible class. Indiana has five, two and three. Iowa has four in the even and two in the possible. Kansas has two leaning and one even. Maine has one even and one leaning. Massachusetts has two leaning and two even. Michigan has two, three and one. Nebraska has two leaning. New Jersey has two in the even class. New York, surprisingly enough, has only three leaning and one even.

But Ohio has ten leaning, three even and three possible! Pennsylvania has six leaning and thirteen even. And West Virginia has three even.

It must be emphasized that this is a rock-bottom table. Even the "possible" classification does not include districts now reported as leaning "slightly Democratic." Its conservatism is well shown in the New York figures. In the present House, New York has 29 Democratic members and only sixteen Republicans. Yet a gain of only four is indicated, in which only the old Seventeenth—silk stocking district, represented by Ogden L. Mills for years and later by Mrs. Ruth Pratt—and the old La Guardia district are included for the Greater City.

The Pennsylvania claim may seem extravagant. But the present delegation has 23 Democrats and only eleven Republicans. In 1924 the Republicans elected every single congressional candidate, and actually there is only one district in the state regarded as strongly Democratic.

Another state in which the reports may seem unduly optimistic is Ohio. But actually Ohio only went around 70,000 for Roosevelt in 1932. It has a strong Republican candidate for Governor against an unpopular Democratic incumbent, and it regards Governor Landon as virtually a native son. His mother left Youngstown just before he was born and moved over—temporarily the Ohio folks are saying—to West Middlesex, Pa.

The present delegation from the Buckeye State has eighteen Democrats and six Republicans. Actually only two surely Democratic districts in the state are those in Cleveland. Yet the report shows only ten districts as leaning Republican, three fifty-fifty and three under the possible heading.

IN MAINE the Republicans confidently expect to capture all three districts, though the one now represented by Moran—not a candidate for re-election—is conceded as fifty-fifty.

It is interesting that the one district put in the possible column in Oklahoma is that centering on Tulsa, the oil capital of that region. Landon has a host of enthusiastic friends through the oil-producing section.

West Virginia is now represented by six Democrats, yet no district in the state is put in the leaning Republican column in the calculations given above. Only three are in the fifty-fifty column. This despite the bitter factional row between the two Democratic Senators, Neely and Holt, which has been limelighted by Holt's fierce attack on federal relief being turned into a factional partisan machine in that state.

Maryland has six Democrats now. Yet only one district is claimed as possible. Despite the recent "America Speaks" poll, showing Maryland 53 per cent for Roosevelt and 47 per cent for Landon, best opinion in Washington is the Free State will go for Landon. In which case the tail may go with the hide.

NEWS OF THE WEEK

Ten-Million-Dollar Program Started by Utility Company . . . Central Valley Asks Exclusive Rights . . . Rural Service and Rate Reports Issued . . . Electrical Sales Rise Sharply . . . Company Employees Buy 2,076 Ranges in One Month

Ten-Million-Dollar Program Started by St. Louis Utility

Contract awarded for 75,000-Kw. turbo-generator, auxiliaries and improvements for Union Electric Light & Power Company as output of company reaches all-time peak

Louis H. Egan, president of the Union Electric Light & Power Company, announces the awarding of a contract to the General Electric Company, Schenectady, N. Y., for the construction and installation of a 75,000-kw. turbo-generator for the Cahokia, Ill., steam power plant.

It is anticipated that this unit will be put into service about February 1, 1938. It will bring the capacity of the Cahokia plant to 310,000 kw., making it one of the largest steam-electric generating plants of the Middle West.

Later the company will award contracts for boilers, stokers, switchboards, station wiring, etc., and other auxiliary equipment and appurtenances that are necessary accompaniments of the turbo-generator. The total cost of the turbo-generator and auxiliaries is said to be about $6,000,000.

These improvements will be part of the $10,000,000 outlay contemplated by the Union Electric for the next 18 months. In recent years the company has been expending about $2,500,000 annually for ordinary additions and betterments. These include meters, cables, transformers and the customary equipment necessary to serve new customers. The system now serves about 333,000 customers and is increasing at the rate of about 1,000 new customers each month.

On July 7 the system had the largest day of its entire history, the total output being 7,100,000 kw.-hr. President Egan attributed the increase in the company's business in recent months to the generally improved business conditions in the territory it serves and also to the increased use of electricity for domestic cooking and other household uses and for air-conditioning installations in many commercial houses and in homes. The company operates four steam plants and hydro-electric plants at Keokuk, Iowa, and the Bagnell Dam on the Lake of the Ozarks in central Missouri.

The Missouri State Public Service Commission recently completed its hearing on the appraisal and audit of the Union Electric Light & Power Company's property valuation to be used as the basis for the determination of future rates for electricity in St. Louis. The city and the company have until August 24 to file briefs to support their contentions at the recent hearing and an additional ten days for reply briefs. A ruling in the case is not expected until early autumn, according to Sam Hargus, chairman of the commission.

•

Central Valley Asks Exclusive Rights

Seeking to protect future power markets for the Central Valley project, the California Water Project Authority has filed a brief with the State Railroad Commission asking for the establishment of a definite policy regarding the granting of future power permits in the territory to be served by the project. The brief bears upon the application of the Southern California Edison Company and the San Joaquin Light & Power Corporation for ratification of a power sales contract involving transfer of Edison surplus power occasioned by the introduction of Boulder Dam power into the southern California market.

Three points are proposed by the authority: (1) That no future permits be granted to private companies which will interfere with the marketing of power developed by the Central Valley project; (2) that inasmuch as C.V.P. is a going public project, it be granted priority to new markets, and (3) that nothing be done now which will prove of future injury to C.V.P.

The Central Valley project appeared in the news a month ago when Congress eliminated $16,000,000 provided in the Senate bill for the project with the understanding that the immediate contract obligations of the government on this project would be taken care of to the extent of $6,100,000 in the deficiency appropriation bill, supplementing P.W.A. allotment of $8,900,000.

•

Employees Regain $3,500,000 in Pay

Full restoration of the reduction in pay of employees of the Consolidated Edison Company of New York and its affiliated gas, electric and steam companies will be made effective August 16, 1936, Frank W. Smith, president, said on Wednesday. For virtually all employees this means a 4 1/6 per cent increase, amounting to approximately $3,500,000 a year.

•

Maryland Rural Area May Be Divided

A public hearing held by the Maryland Public Service Commission in Baltimore on an application filed by the newly formed Consumers' Co-operative Company for permission to build about 70 miles of electric power lines in Calvert County has been concluded. In addition to seeking permission to exercise a franchise granted by the County Commissioners for the construction of the line the co-operative also asked the commission to rescind permission granted to the Maryland Light & Power Company to construct two lines in the territory involved. Maryland Light & Power Company opposed the application.

Much interest has been aroused by the application and officials of several other companies, including Consolidated Gas, Electric Light & Power Company, Baltimore, and Potomac Electric Power Company, Washington, were interested spectators during the formal hearing.

The question of construction costs occupied considerable time at the hearing, engineers for the co-operative claiming the work could be done for about $1,100 a mile, while representatives of Maryland Light & Power contended it would cost in the neighborhood of $1,500. The new company announced that a loan of $90,000 from the Rural Electrification Administration has been approved.

At the conclusion of the testimony at the hearing the commission announced that it would grant the attorneys for the company time to file briefs in the case.

•

Michigan Plans Rural Lines

Construction of 350 miles of lines to supply electric current to farms in Jackson, Livingston, Eaton and Ingham counties is to be started within a few days, or as soon as arrangements can be completed, following receipt of $70,000 initial allotment from the Rural Electrification Administration to the Ingham County Electric Co-operative, Inc., of Mason, Mich. The project will supply electricity to nearly 2,000 farms.

Loup River Group Faces New Plans

It has been suggested by the directors of the Loup River Public Power district that they make some kind of connection with the Central Nebraska Public Power district. The officers of the latter have been approached on the matter, but no action has been taken. When the Supreme Court of the District of Columbia signed a restraining order in the suit brought by five Nebraska power companies against the P.W.A. plan for power development in the state P.W.A. dropped its move to link the Platte Valley, Central Nebraska and Loup River districts into one connection. The interconnection agreement has been rescinded. The Platte Valley district was opposed to the move from the start and was forced into the agreement by the P.W.A., it is reported.

The Central Nebraska directors, due to recent court decisions, are reported to be considerably puzzled as to what action they will take next. The decision of the Supreme Court in District of Columbia nullified all power phases of the project. In the Nebraska Supreme Court opponents won a decision which whittled from the plans 60 per cent of its irrigation program.

Bewildered officials are trying to figure out where that leaves them. Unless there are some new developments the directors plan to go ahead with a part of their program. They will build irrigation ditches for that portion of their territory which lies in the Platte Valley watershed, some 200,000 acres of the 500,000 acres planned for in the original scheme.

•

Louisville Case Approaches Solution

Decision whether the Louisville Gas & Electric Company will be given a twenty-year franchise was delayed two weeks by a recent hearing at Louisville. The delay will cost county consumers of gas and electricity nearly $1,000 a week, T. B. Wilson, president of the gas and electric company, said. He asserted the county consumers will save $50,000 a year on the rates proposed by the company.

Final steps to close the city's part in the rate fight have now been taken. Roy W. Burks sold the franchise recently authorized by the Board of Aldermen to the company for $25,000, the upset price fixed by ordinance. At a special night session the Aldermen passed a resolution accepting the company's bid. The Aldermen also received and transmitted to John R. Lindsay, Director of Finance, the company's acceptance of the new rate ordinance and the company directorate's resolution authorizing the acceptance.

On July 9 the company sent a check to the city for $64,141, the balance due on expenses in connection with the city's inquiry into rate matters; it also put up a $50,000 performance bond, and at 10 a.m. its counsel and the city's legal staff entered an agreed order in federal court accepting the rates set up as of July 1.

This action closed the case, which began more than two years ago, ending in a compromise rate for two years, to give time for the rate investigation.

•

Air Survey Costs Only $550

The Hydro-Electric Commission of Oregon has been in the forefront in utilizing the airplane to survey by camera the extensive rural territory under its jurisdiction. The methods employed by the commission and examples of the finished aerial survey were described in some detail in ELECTRICAL WORLD June 20, 1936.

The cost of the survey as described was only $550 and embraced a territory of 410 square miles. ELECTRICAL WORLD regrets that the previous cost was incorrect as published and hastens to publish this correction.

OBERMEYER IS VOX POPPED

Henry Obermeyer, assistant to the executive vice-president and director of the Advertising Bureau of the Consolidated Edison Company of New York City, is shown in front of the NBC and Intercity network microphones as he was interviewed by Jerry Belcher (left, back to camera) and Parks Johnson (right), the NBC-Vox Pop radio interviewers, at the general sessions luncheon of the 32d annual convention of the Advertising Federation of America in the Hotel Statler, Boston. In the rear at the right smoking pipe is Raymond A. Moley, editor of the magazine *Today* and former New Deal Brain Truster.

Rural Electric Service and Rate Reports Issued by Commission

Rural service, monthly bills and construction costs and practices detailed in Rate Series Report — Publicly and privately owned rates listed

The Federal Power Commission this week issued two new reports, "Rural Electric Service" (Rate Series No. 8) and "Comparative Rates of Publicly and Privately Owned Electric Utilities" (Rate Series No. 5).

The report on Rural Electric Service contains more than 125 pages of data on rural line extension policies, construction practices, costs of rural construction, number of farm customers, distribution of customers by usage, rate schedules and monthly bills, rural line mileage and investment figures for lines.

This report, states Commissioner Basil Manly in the foreword, "reflects but one phase of the many problems involved in rural electrification and reveals the conditions which existed prior to the initiation of the federal program for the extension of rural electric service."

It is to be noted that 1933 figures are cited for customer sales and revenue figures and may now be useful principally for comparison with up-to-date figures.

Other data, however, such as that pertaining to extension policies, rate schedules, line construction and costs, are practically all data for 1935.

"Comparative Rates of Publicly and Privately Owned Electric Utilities" is the title of the second report, which contains 40 pages of data on "average" bills, taxes, contributions and "free services."

Average monthly bills, rather than rates, are shown for residential service in 25,387 communities, as of January 1, 1935; for commercial power and lighting service in approximately 3,440 communities, as of February and March of last year; for large commercial and industrial service in 381 comunities, as of April 1 of last year.

Part 2 of the report contains tables showing taxes, net cash contributions and "free services" for privately and publicly owned utilities as well as for a municipal classification for the years 1933 and 1934.

•

T.V.A. Costs Company Million Per Year

Customers of Georgia Power Company are being charged an extra million dollars per year, the company states, because capital, which is inherently timid, refuses to go to work in Georgia territory at the prevailing wage of 4 per cent and less due to threats of T.V.A. competition.

In effect, dollars which will go to work for Consumers Power Company at 3½ per cent, for New York Edison at 3¼ per cent, for Pacific Gas & Electric at 3¾ per cent, insist upon the higher wages of 5 and 6 per cent if they face the T.V.A. threat, says the company's announcement.

If Georgia Power Company could refinance at 4 per cent, for example, the company computes an annual saving of $1,180,913 which would be available for lower rates in Georgia, more jobs for Georgians or more rural lines for Georgia.

•

Electrical Sales Rise Sharply

Manufacturers' sales of electrical machinery, apparatus and supplies in May were 11.9 per cent greater than in April and 24.2 per cent above May, 1935, according to a report by the Department of Commerce. The statement is based on returns of 22 manufacturers whose sales amounted to $20,761,000 compared with $18,557,000 in the preceding month and $16,741,000 a year ago. Business in this group is running well ahead of the average for all industries, which showed a negligible recession, 0.1 per cent, from April and an advance of 18.1 per cent over the month in 1935.

In the rate of gain compared with May, 1935, it was exceeded by only five of the fourteen groups listed: Iron and steel and their products, 46.1 per cent; rubber products, 31.0; forest products, 28.4; motor vehicle parts (no figures are given for motor vehicles as a whole) 26.1; machinery, not including transportation equipment, 25.7 per cent;

SEVEN-MILLION-DOLLAR ERROR?

International News Reel

U. S. citizens and taxpayers who visit New England this summer may gaze upon Treat-Dudley Dam, shown above, which, with the village, represents the results of $6,700,000 buried in the famous Passamaquoddy project.

every one of these is importantly affected by activity in building construction or automobile production.

Collections are closely in step with those of all industries combined. These are expressed as a percentage of the accounts receivable at the beginning of the month and the median percentage is reported. Taken in the order May, 1936—May, 1935—April, 1936, they are: 79.0, 79.7, 84.6 for electrical as against 79.4, 79.0, 79.2 for all industry.

Sales of electrical goods by wholesalers, 104 reporting, show similar progress, with a gain of 9.0 per cent over April and 29.4 per cent over May, 1935.

•

Yardstick Stretched an Extra Foot

The Northwest Electric Light and Power Association advises that when it comes to power "yardsticks" not only city residents but also farmers and residents of rural communities in the lower Willamette Valley have one that measures 47.5 inches!

This optimistic statement is based on an analysis made by the Northwest Electric Light and Power Association of the Federal Power Commission's latest electric rate survey.

"Both city and rural customers in this territory get 32 per cent more electric energy for every dollar they pay on their electric bills than the average American user—an 'extra 11½ inches' added to the 36-inch national average yardstick." This extra 11½ inches applies to homes using 250 kw.-hr. a month—the amount required for lighting, refrigeration, cooking and operation of various appliances.

"Outside the lower Willamette Valley, rare is the rural district enjoying the same electric rates as big cities. That is because it costs much more per customer to deliver energy in rural districts than it does in crowded cities. And the cost of distribution, as every one knows, is many times the cost of generating electricity. But despite this fact, it has long been the policy of the power companies serving this territory to have the same rates in city and country."

•

Pepco Plans Rural Lines

A rural electrification program costing more than $100,000 and involving construction of 135 miles of new rural service lines, to be added to Pepco's present rural system of 2,300 miles, was recently announced by Franklin T. Griffith, president of the Portland Electric Power Company.

The 1936 program will be approximately one-third greater than last year's construction. One hundred miles were added in 1935.

New York & Queens Employees Buy 2,076 Ranges in One Month

Employees of New York & Queens Electric Light & Power Company purchased 2,076 electric ranges in the month ended July 9, in a campaign headed by L. J. Montgomery, general sales manager of the company.

The boys and girls apparently figured they wanted modern refrigeration also in their own homes, for they purchased more than 600 electric refrigerators during the same 30-day period.

Benefits of electric cookery were explained to the 4,500 or so employees by 155 committeemen organized into thirteen departments. The committeemen met each week night, heard a talk by Mr. Montgomery, saw a cookery demonstration by Doris B. Scott, director of home economics.

Inducements offered to employees were: Special discount from range list price, no financing charge, no interest charge, four years to pay, payments automatically deducted from pay checks, $10 allowance on old range, gift of $15 set of cooking utensils, free installation including necessary wiring.

Auditors' department made greatest collective rush for ranges available on above liberal terms for 83 per cent of the department bought, and to it Executive Vice-President Lawrence A. Coleman presented the winner's cup as the campaign closed last week. Of interest also is the fact that 859 members of the distribution department signed on the dotted line for new electric ranges.

•

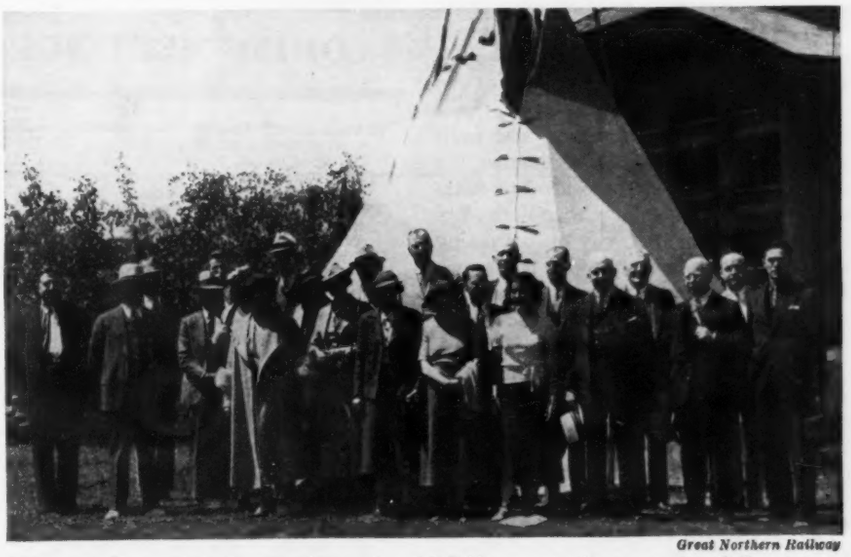
Refrigerator Sales of 363 in One Day

"Sales Day was the most successful concerted effort I ever heard of in a utility organization," President George R. Jones telegraphed employees of his Illinois Northern Utilities Company after they sold 363 electric refrigerators in a single day.

One employee, L. Matthews, sold twenty refrigerators on the special sales day; Lester Berry sold fourteen, and four others sold more than ten each.

Illinois Northern is very active in rural construction. Its budget of 600 new rural customers has already been exceeded and the company expects that 1,500 to 1,800 customers may be secured this year. Eight crews comprise the construction forces, which are working behind an earth-boring and pole-setting machine.

"HAVING FINE TIME, WISH YOU WERE HERE"



Great Northern Railway

Homeward-bound delegates from the A.I.E.E. convention are rounded up outside the Glacier National Park Hotel

Shown above, left to right: Mr. Conkley, Minneapolis; E. B. Meyer, Newark, N. J.; C. V. Thompson, Philadelphia; Mrs. Conkley, Minneapolis; Mrs. Meyers, Newark, N. J.; I. M. Stein, Schenectady, N. Y.; Miss Broman, Schenectady, N. Y.; Dr. W. E. Wickenden, Cleveland; H. P. Seelye, Detroit; J. J. Pokoring, Cleveland; A. C. Leibring, Indianapolis; H. V. Osgood, Mrs. Osgood, Washington, D. C.; C. L. Pfeiffer, Milwaukee; Mrs. H. S. Phelps, Mrs. I. M. Stein, H. S. Phelps, Philadelphia; G. M. Miller, Louisville; R. L. Cornwell, Newark, N. J.; R. L. Webb, New York City; H. B. Geare, Chicago; F. P. West, New York City.

Ohio Brass Offers Impulse Control Gap

(Received by Wire)

Some four years of research development at the Ohio Brass Company laboratories has borne fruit in two new products announced at a press preview this week. One is an impulse control gap for protection of station equipment from 34 to 161 kw., with a 230-kw. unit still in development.

The other is a metallized-head pin-type insulator which is free of radio interference at a voltage at least 70 per cent higher than the equivalent standard design. It has the same dimensions and general appearance as the standard product.

The new control gap has been aimed at the 1½ to 5 microsecond range which is the prime concern of utility engineers striving for both maximum service continuity and minimum equipment damage. Its primary function is to divert nearby direct strokes with practically identical performance on either polarity of surge.

Combines rod and sphere

In principle, the new device incorporates points for discharge, this introducing the desirable characteristics of the rod gap and a group of flux distributing insulators introducing the flat time lag characteristics of the sphere gap. The rod component, however, averts the undesirable characteristics of the sphere gap. In wet weather the three control insulators (six for the higher voltage units) can be adjusted relative to the central points both circumferentially and axially to establish any reasonable shape of time lag curve for optimum insulation co-ordination and for maximum benefit from arresters and other protective equipment.

Addressed thus to the economical protection of the most expensive and most vulnerable units of station equipment, the device is founded on the control of flashover through the medium of uniform flux distribution. Another way of expressing the intent and demonstrated performance is that it combines the impulse characteristics of the sphere gap with the power frequency characteristics of the rod gap.

For over 100 kw. the unit is made multigap with capacity grading of potential. Separations are thus kept small so as to avoid too much injection of rod gap characteristics.

•

Water Flows Into Hawks Nest Tunnel

Water rushed at full volume through the 3½-mile long Hawks Nest tunnel, at Gauley Bridge, W. Va., the other night for the first time since construction began in 1930. The Electro-Metallurgical Company will use the 120,000 electric horsepower generated at the hydro-electric plant to operate a metal-working plant at Alloy, about 30 miles above Charleston.

L. H. Davis of New York, who is in charge of the development, said: "The additional power will make it possible for the company, when business conditions warrant, to employ several hundred additional workers."

•

Detroit to Have New Street Lights

An installation of more than 1,600 new-type luminaires, which are equipped with newly designed reflectors and use deflectors said to more than double the amount of light put on the street by conventional units, will aid Detroit in its campaign to promote safe driving at night. The new units, to be furnished by the General Electric Company, will have concealed light sources to suppress glare.

Similar equipment is now in operation along Woodward Avenue and other streets where 230 of the luminaires are in use. According to L. J. Schrenk, superintendent of the Detroit Public Lighting Commission, these lamps have accomplished the joint objective of giving a smooth uniform light on the street and reducing glare.

The motor city is one of an increasing number now utilizing the new-type luminaire in the promotion of safety for the night driver. Other important cities are Lynn, Mass.; Richmond, Va., and New York.

COMING MEETINGS

Illuminating Engineering Society—Annual convention, Statler Hotel, Buffalo, N. Y. August 31-September 3. A. D. Cameron, general secretary, 29 West 39th Street, New York.

Third World Power Conference—Washington, D. C., September 7-12. Joel Wolfsohn, executive secretary, Interior Building, Washington, D. C.

International Association of Electrical Inspectors — Eastern section, Hotel New Yorker, New York, September 8-10; Northwestern section, Olympian Hotel, Olympia, Wash., September 14-16.

National Electrical and Radio Exposition — Grand Central Palace, New York, N. Y., September 9-19. Ralph Neumuller, secretary, 480 Lexington Avenue, New York, N. Y.

Rocky Mountain Electrical Association—Annual convention, Santa Fe, N. M., September 21-23. George E. Lewis, managing director, Gas and Electric Building, Denver, Colo.

Association of Iron and Steel Electrical Engineers — Annual convention, Detroit, Mich., September 22-25. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Empire State Gas & Electric Association—Annual meeting, Saranac Inn, N. Y., October 1-2. C. H. B. Chapin, secretary, Grand Central Terminal, New York, N. Y.

Electrochemical Society—Fall meeting, Niagara Falls, Ontario, October 7-10. Colin G. Fink, secretary, Columbia University, New York, N. Y.

State Power Vote Again Petitioned

Voters of Oregon will be called upon next November to pass again upon a measure designed to put the state into the power business. The measure, sponsored by the State Grange and the State Federation of Labor, would authorize the state to purchase electric energy from the Bonneville power plant and either secure transmission of the power over lines to be built by the federal government or build its own lines to transmit the power to the point of consumption either by municipalities or people's power districts, of which three are now under consideration.

Provisions of the power act, if approved, would be administered by a nonpartisan electric commission of three members except that a proposed constitutional amendment to be voted on also in November authorizes the state board of control temporarily to administer the act until the power board can be elected. Completed petitions assuring the two measures a place on the general election ballot were filed with the state department Thursday. A similar measure was defeated by the voters by a substantial majority in November, 1934.

•

Street Lighting on Objective Rate

To increase use of street-lighting service through reduced power costs, Alabama Power Company is offering municipalities an "objective" rate patterned after the rate plan adopted for residential customers three years ago. Approving the new rate, the Alabama Public Service Commission said the plan "will make available to the towns served by the power company more lighting at no increase in cost.

"It is estimated," the commission stated, "that a total increase of 58 per cent in the lighting of the 187 towns presently served by the power company with street lighting or white way service, or both, will be available."

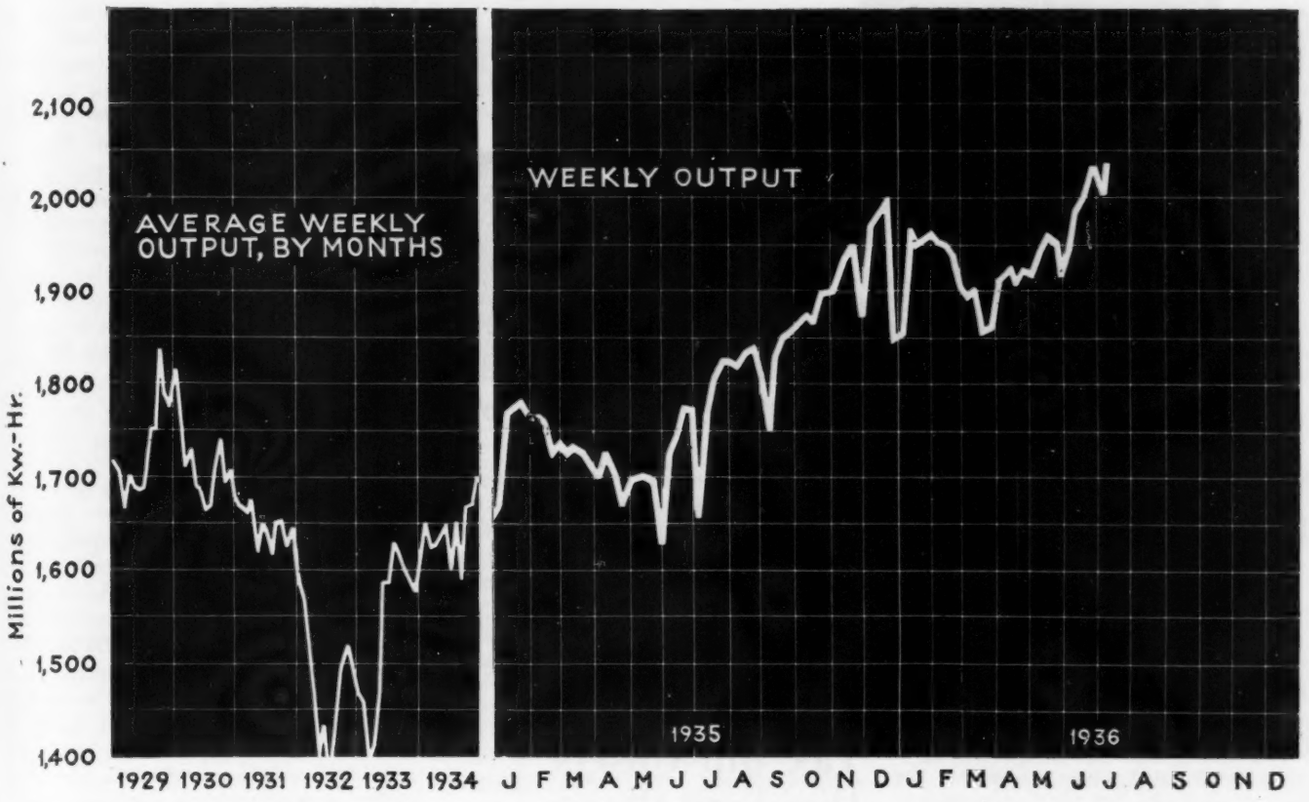
Application of the objective rate is contingent upon a city's contracting with the power company for street-lighting service for a minimum period of five years. After five years the contract may be renewed on a year-to-year basis.

•

Company to Exhibit at Fair

Memphis Power & Light Company is planning an electrical show at the Mid-South Fair, to be held in Memphis for one week in September. It is a new feature.

Output Matches Previous Peak



Recovering from an unusually small decline in the week of Independence Day, the output of electric light and power plants last week, as reported by the Edison Electric Institute, amounted to 2,029,704,000 kw.-hr. This was almost identical with the figure for the week ended June 27, 2,029,639,000 kw.-hr., which was a new record for any week at any season of the year. The tentative figure previously announced for the intervening week has been revised to 1,956,230,000 kw.-hr.

Gains over other years are being fully maintained. The percentage over the corresponding week of last year stands at 14.9 and compared with 1929 it has risen to 18.5 as against 18.1 in the week ended June 20. Earlier in the year the advance over pre-depression maxima was much smaller. Because the holiday week was abnormal regional gains are given for the two-week period.

Per Cent Change from Previous Year

	Two Weeks ended July 11	Week June 27
New England.....	+16.9	+13.9
Middle Atlantic....	+11.8	+10.7
Central Industrial..	+21.3	+21.0
West Central.....	+18.4	+16.3
Southern States....	+20.1	+16.6
Rocky Mountain...	+28.0	+27.7
Pacific Coast.....	+13.0	+10.5
United States.....	+14.9	+14.5

Weekly Output, Millions of Kw.Hr.

1936	1935	1934
July 11...2,030	July 13...1,766	July 14...1,648
July 4...1,956	July 6...1,655	July 7...1,556
June 27...2,030	June 29...1,772	June 30...1,688
June 20...2,005	June 22...1,775	June 23...1,675
June 13...1,990	June 15...1,743	June 16...1,665
June 6...1,945	June 8...1,724	June 9...1,655

Air Conditioning at Ohio Public Service

Comprehensive plans for the promotion of air conditioning in connection with hot air furnaces are under way in the territory of the Ohio Public Service Company in an effort to secure a usage of 500 kw.-hr. per year per installation, says C. L. Dunn, general new-business manager of the company.

A three-part plan has been designed to attract architects, contractors and builders and heating, ventilation and air-conditioning dealers.

As Mr. Dunn finds that 95 per cent of the homes in his territory of 259 Ohio communities cost less than $10,000 and are therefore subject to contractors' advice rather than architects' advice, his program has been mapped out to assist them completely.

For example, two outside signs calling attention to air-conditioned homes are supplied by the company; such homes will be floodlighted free of charge for a period of ten days and the company will insert 25-line advertisements in the daily papers for the ten-day period that the air-conditioned home is open for inspection.

•

Income Sets New May Record

Revenue from sales of energy for electric light and power to ultimate consumers in May amounted to $164,014,600, according to the Edison Electric Institute. This shows an increase of 7.1 per cent compared with a year ago. Previous records for the month were definitely surpassed. The nearest approach to the present figure was $161,348,700, in May, 1930.

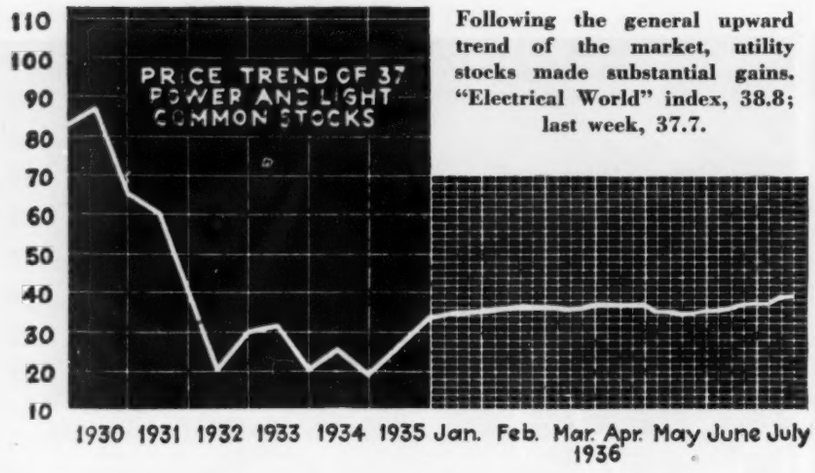
•

Dayton Power & Light to Rush $3,000,000 Project

With the approach of a possible steel strike in the United States, suspension of steel mill activities will have no effect upon the construction of the new $3,000,000 improvement project to the Miller's Ford plant of the Dayton Power & Light Company, it is reported. For the past two weeks carloads of steel have been received at the site of the new addition and company officials see no possibility of the strike having any effect upon construction activities.

The project is expected to be ready for operation by April 1, 1937.

Utility Stocks Forge Ahead



Following the general upward trend of the market, utility stocks made substantial gains. "Electrical World" index, 38.8; last week, 37.7.

S.E.C. Exercises Financial Control

For the first time the Securities and Exchange Commission has exercised powers conferred by Section 7-d of the Public Utility Holding Company Act of 1935 by requiring important changes in two security issues proposed by Sioux City (Iowa) Gas & Electric Company.

Hearings have been called for the past three weeks, but were adjourned, it was said, at request of company counsel. At the latest public hearing it was learned that as a result of the various conferences the company had agreed to make three important changes in the indentures covering a proposed $9,000,000 issue of 4 per cent bonds and a $1,500,000 issue of debentures.

First change was to discontinue "open end" provisions of debentures' indenture and prohibit issuance of any further securities under that agreement. Secondly, the agreement was altered to state that no cash dividends may be declared or paid on any class of stock unless they are paid out of earned surplus which accrued subsequent to July 1, 1935.

Third restriction imposed required specific amounts for maintenance and repair of property covered by mortgage bonds, in this case 15 per cent annually of gross operating revenue for so long as any of the bonds are outstanding.

•

Massachusetts Utility Group to Issue Stock

The Massachusetts Department of Public Utilities has granted petitions filed by the United Electric Light Company of Springfield, Pittsfield Electric Company and Western Massachusetts Electric Company, controlled by Western Massachusetts Company, requesting authority to issue additional stock.

United Electric will issue 22,000 shares of $25 par stock at $65 a share; Western Massachusetts Electric, 4,000 shares at $125 a share, and Pittsfield Electric, 3,000 shares at $125 a share. The price in each instance has been fixed by the department. Proceeds will be applied to the payment of promissory notes and other obligations of the various companies.

•

Tax Bill Upsets Dividend Plans

"The involved and complex provisions of the recently enacted federal tax bill," said H. Hobart Porter, president American Water Works & Electric Company, last week, "make it unwise, in the opinion of directors, to declare a dividend on the common stock until the effects of the bill can be ascertained."

American Water Works earnings have shown steady improvement since the depression, and as earnings on the common amounted to $1.49 for the twelve months ended May 31, common-stock holders were reported to be anticipating some disbursement on their investments.

However, Mr. Porter calls attention to the fact that the tax bill is new in principle and its probable effects on business are unknown (see ELECTRICAL WORLD, June 27, page 30).

"It was passed over the protests of practically all business representatives who appeared before the Congressional committees," Mr. Porter added, "and until studies have been completed it will not be possible for your directors to act wisely in resuming a dividend on the common stock."

SNAPPED AT HEARING ON CONSOLIDATION

F. J. Dunn, representing Narragansett Electric Company, is shown here at left presenting company's plans to acquire two smaller companies to Federal Power Commission Attorneys John R. Curry and Charles M. Goetz.

•

Refunding Costs Hit All-Time Low

This month's award for impregnable financial condition, if there were such an award, might well be bestowed upon Potomac Electric Power Company for its successful flotation of a $15,000,000, 30-year, 3¼ per cent issue. The bonds went to bankers at a price reported to be 103 plus, and were offered at 104, to yield 3.04 per cent.

Seldom indeed nowadays is a public utility company in a position which could be described as enviable. Three reasons why Potomac Electric merits this description are: Sound financial structure, excellent record of earnings and the Washington plan of rate regulation. Before refinancing, interest on funded and refunded debt, other interest charges and amortization were covered 6½ times.

Finally, while sporadic efforts have been made by candidates for political office in the District of Columbia to upset the Washington Plan, calmer counsels have prevailed, and the plan has been allowed to operate without the tintinnabulations of petty politics.

•

United Cities Utility Applies for Exemption

United Cities Utility Company of Chicago, a registered holding company, has applied to the S.E.C. for exemption from Section 13 (A) of the Public Utility Holding Act of 1935. The act prohibits the performance of service, sales or construction contracts by registered holding companies for their associate public utility companies and provides instead for the performance of such contracts by serving companies.

The commission, however, is authorized to make exceptions to this rule in cases where it finds that "special or unusual circumstances" are involved. United Cities claims that it is, in effect, "an operating or service company," although legally a holding company.

MANUFACTURING AND MARKETS

Commerce Bureau Issues Market Data

Manufacturers of electrical equipment used in the textile industries will find useful market data in the publication of the Bureau of Foreign and Domestic Commerce, recording the location and density of that industry by counties. Separate statistics are given for the several branches—cotton, woolens and worsteds, silks and rayon, knitting. Tables and maps show the quantity of machinery in place by counties, in addition to Census statistics by states on number of wage earners, wages, cost of materials, value of products and other items.

No electrical statistics are given, but reference to the 1929 Census of Manufactures, the latest giving data on power installations, will enable the user to draw approximate conclusions. For example, in the manufacture of cotton goods the installed horsepower per wage earner in that year averaged 5.35. Of the total horsepower about 66 per cent was in electric motors, driven either on purchased energy or energy generated in the manufacturers' own plants.

The publication in question is stated to be the first of a series intended to show the major market in industrial machinery, equipment and supplies. Its full title is "Basic Industrial Markets in the United States—The Textile Industries." Copies may be obtained from the Bureau of Foreign and Domestic Commerce in Washington or any district office of the bureau at 10 cents a copy.

•

A.S.T.M. Discusses Insulating Materials

Four papers on electrical insulating materials were among those presented for discussion at the 39th annual meeting of the American Society for Testing Materials at Atlantic City the first of the month.

F. M. Clark, chemist, General Electric Company, and E. A. Snyder, Socony-Vacuum Oil Company, Inc., summarized a co-operative test program on sludge formation tests in mineral transformer oils. Robert Burns, Bell Telephone Laboratories, Inc., presented a paper on "Conditioning of Insulating Materials for Test," and H. L. Curtis and A. H. Scott of the National Bureau of Standards spoke on "Edge Correction in the Determination of Dielectric Constant."

L. E. Barringer, General Electric's engineer of insulations, discussed "Significance of Material Tests and of Design Tests Upon Electrical Insulating Materials."

•

Power Distribution Cost Study Ended

Federal Power Commission recently issued its report on the cost of distribution of electricity which concerns "one of the most complex and important, yet least explored, elements in the entire field of electric light and power." Vice-Chairman Basil Manly, commissioner-in-charge, said the study made by the commission's national power survey covers the cost of retail distribution of electric energy from local substations to customers' meters, including commercial, industrial and rural, as well as residential.

Surveys and investigations were made of the distribution systems and records of 22 private and municipal electric-utility systems serving urban or rural territory, or both, which reflect a wide variety of service conditions.

Concerning residential service in urban territory, the report says the lowest distribution system investment per customer is $45.18 at Lewisburg, Pa., while the highest was $117.99 for the Puget Sound Power & Light Company of Seattle. High investment cost was attributed in this instance to competition from municipal plant.

Commercial service costs in urban territory per customer range from $102.58 on the Bristol, Tenn., overhead system to $1,303.36 at Hershey, Pa., where more than 60 per cent of investment is in underground system.

A comparison of figures in industrial service was included.

•

215,000 Tons of Copper in 1935

Consumption of copper for electrical manufactures in the United States rose to a maximum of 261,000 tons in 1929 and fell to 90,000 tons in 1932 and in 1933, then rose to 128,000 tons in 1935, according to estimates published in the Year Book of the American Bureau of Metal Statistics for 1935. The course during intervening years is shown on the chart. The category "electrical manufacturers"

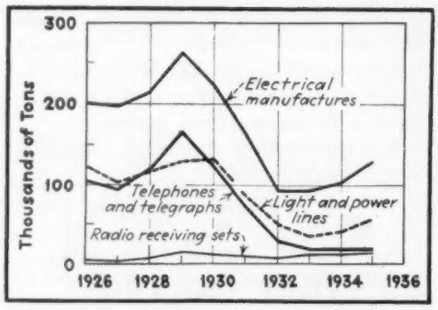
"LARGEST IN THE WORLD"

"The largest air-conditioned, air-cooled hotel convention area in the world," said Chicago's Hotel Stevens as Carrier Engineering's Chairman Willis H. Carrier (extreme right) started this new unit. Second and third from left are, respectively, Rufus C. Dawes and Otto K. Eitel

is stated to comprise generators, motors, electric locomotives, switchboards, light bulbs, etc.

Consumption for telephones and telegraphs rose to a peak of 164,000 tons in 1929 and for light and power lines, including transmission and distribution wires and busbars, to 130,000 tons in 1930. Radio receiving sets consumed 15,500 tons in 1929 and 14,200 tons in 1935.

In general the annual consumption during the low years was only one-third as great as in the pre-depression peak, but in the case of telephones and telegraphs



Copper used for electrical purposes

the decline was far more severe, the minimum being only one-ninth of the maximum. The past two years have brought a pronounced increase.

Although the total use of copper for all purposes varied widely, from 1,159,800 tons in 1929 to 368,000 tons in 1932 and 567,000 tons in 1935, the percentage for electrical manufactures remained within a narrow range, the maximum being 24.91 per cent in 1931 and the minimum 21.50 in 1928. In 1935 it was 22.58 per cent.

•

Announce Drive for Air Conditioning

More than 15,000 air-conditioning and warm-air heating dealers and contractors are to sponsor a "National Warm-Air Heating and Air-Conditioning Week," August 17 to 22, it was announced at the annual convention at Cleveland.

Air-conditioning equipment manufacturers and furnace manufacturers will co-operate, it is said, in a campaign to inform the public as to the true definition of air conditioning, its proper functions and correct installation.

New York Metal Prices

	July 7, 1936 Cents per Pound	July 14, 1936 Cents per Pound
Copper electrolytic	9.50*	9.50
Lead, Am. S. & R. price	4.60	4.60
Antimony	11.125	11.125
Nickel ingot	30.50	35.00
Zinc spot	5.125	5.125
Tin Straits	42.125	44.375
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley.

Field Reports on Business

Reports to ELECTRICAL WORLD *from the field indicate that business has gone forging along in July—despite heat, drought, politics and the prospect of big strikes. Steel, electric energy and automobile production figures all make good reading; the let-down which was expected this month looks as though it might be put off into August. That would mean only a short lapse before anticipated autumn improvement.*

PACIFIC COAST

From all sides come such encouraging reports as a 20 per cent increase in retail sales, even one month after first burst of bonus buying, gradual disappearance of overstock and widespread shortage of skilled workmen, though this is partially due to their dispersion to other fields during the building depression. This construction boom is nowhere near its peak, because industrial building seems still distrustful of conditions. A very encouraging factor is the failure of a certain labor element in the Bay area to subject hardware wholesalers to closed shop and hiring hall conditions. After a three-week shutdown firms are again open with certain warehouse wage adjustments.

Mining business, both dredge and underground, continues excellent, with good orders being placed for both types of equipment and many 3 to 6-mile extensions being made to replace former steam or Diesel installations.

Refrigerators are at peak of July drive with all prior sales records being broken. Such other majors as cleaners and washers are selling fairly well, but stiffer terms have cut down F.H.A. showing during first quarter of the year. An encouraging outcome has been marked increase in sales of table appliances, except in February, when holiday reorders were being liquidated, and July, because of buyers' vacations and midyear inventories dropping to 1935 levels, but all other months averaging a 25 per cent increase. June gifts were especially perceptible.

Power apparatus and machinery manufacturers report an average increase of 25 per cent over last year's business, nearly all in nice staple material, but, being staple material, it is composed of many small orders. The outstanding item for this week is $20,000 for a U. S. Army plant near Honolulu.

CHICAGO

The excessively hot weather brought a rush for electric fans and wholesalers' stocks were pretty well depleted by the end of the week. Worthy of note is the demand for the larger type fan in comparison with the cheaper ones which have been sold during the past few years. The heat also caused a flood of inquiries regarding air-conditioning, while sales of portable room coolers boomed. The rush to summer homes created a greater demand for appliances, particularly electric cookers.

Business stood up well in the face of the impending decline which it has disregarded for a month. Activity last week continued to display a comparatively detached interest in affairs that might be expected to disturb the trend. However, numerous elements have entered the picture, indicating that the seasonal decline, which has held off unsually long this year, is gradually taking effect.

Industrial purchases of electrical equipment show no signs of falling off. Orders from railroad shops and steel mills have materially increased. Some concerns have made unusually heavy commitments for future supplies due to anticipated higher prices. Seventy per cent of the manufacturers reporting to the Electric Association show an increase in sales over the previous month, while 82 per cent show a gain over last year.

NEW YORK

Business throughout the East fairly exudes confidence after passing the middle of the third quarter's initial month without anything like the predicted recession. Drought, politics and labor unrest have been shoved into the background by continued high operations in many lines along with the growing list of excellent earnings statements.

It is noted that automobile output schedules are sagging again, but not very sharply, considering heat that handicaps operations in addition to the approach of the summer shutdown for new models. The steel industry has encountered unusual orders which may or may not be driven in by fear of a strike later. And electric energy production continues to put on its amazing display of new all-time highs during the longest days of the year. The latest record was achieved without benefit of big radio attractions such as the spectacular prizefight or political conventions of June; electric fans, though, worked overtime.

Optimism draws further justification from such actions as that of Consolidated Edison of New York and subsidiaries in restoring pay cuts for all employees, adding about $3,500,000 annually to payrolls.

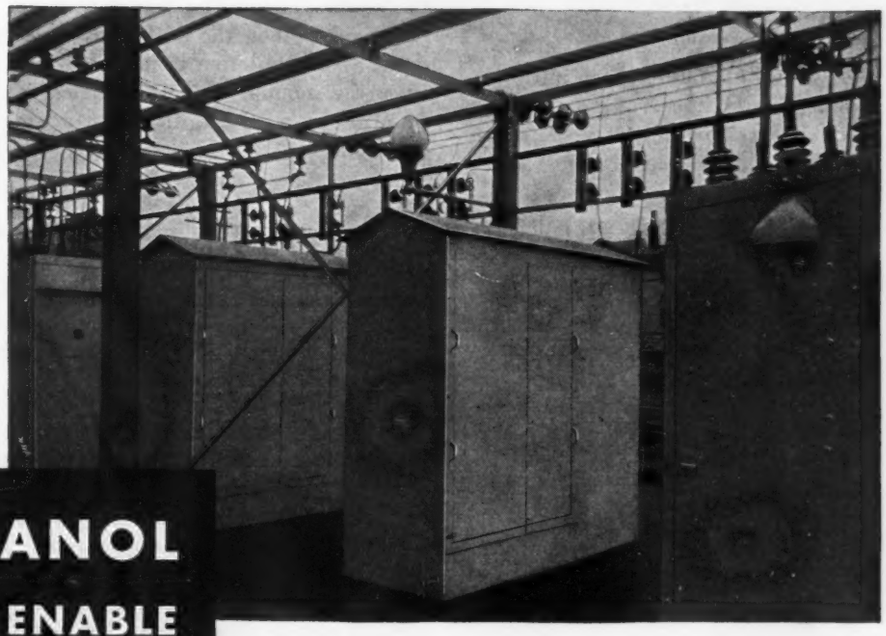
NEW ENGLAND

Reports of power apparatus sales range from steady demand for small motors and control equipment from well known and nationally prominent manufacturers to indications of some falling off in buying from representatives of less prominence in this area. Single motor orders continue to feature in power apparatus sales; fractional horsepower motors in small lot sales are recorded by one manufacturer. Motor sales for air-conditioning equipment are steady; negotiations and inquiries in this field of electrical equipment are very active. New installations pending include equipment for a new six-story building for the Boston Automatic Fire Alarm Company together with extensive wiring layouts for fire alarm signal systems, installation in a Massachusetts State asylum and a probable installation in the Boston City hospital.

A steady demand for wire and cable is indicated by increased activity. An airport, at an estimated cost of $100,000, is under consideration at Concord, Mass. Equipment for manual training purposes in schools is in demand and electrically driven woodworking machinery particularly is desired. Authorization for the expenditure of about $730,000 for additions to the Worcester State Hospital has been passed. The Westinghouse Electric & Manufacturing Company's East Springfield plant is now employing 5,100, a sustained peak.

GAIN CAPACITY *with* CAPACITORS

SOLVE THE PROBLEM OF LACK OF SYSTEM CAPACITY WITH A NEW APPLICATION OF A WELL-TRIED TOOL.



G-E PYRANOL CAPACITORS ENABLE YOU TO GAIN KW CAPACITY ANYWHERE ON YOUR SYSTEM, QUICKLY AND INEXPENSIVELY

WITH central-station loads mounting to new peaks, G-E Pyranol capacitors are assuming a new importance because they return the following benefits with minimum investment:

They Increase Capacity of feeders, regulators, transformers, and cable
They Reduce Losses
They Improve Voltage

Many power companies have already applied G-E Pyranol capacitors to prevent overloading of their circuits, with complete success.

The advantages possessed by this equipment:

1. Low operating cost, due to low losses and low maintenance expense, together with maximum safety because of Pyranol.
2. Low installation cost.
3. Special provisions for ventilation are unnecessary.
4. Special foundations are not required.
5. Flexibility, due to use of individual units of relatively small kva rating.
6. Can be obtained quickly—because of short time required for shipment and installation.
7. 99.87 per cent of the Pyranol capacitors — manufactured in the last five years—have a perfect operating record.

It will pay to investigate this method of adding kw capacity to your system. Ask for reprint GEA-2367, "Capacitors Prove Out in Decade of Service," an article from *Electrical World*. General Electric, Schenectady, N. Y.

360-115

GENERAL ELECTRIC

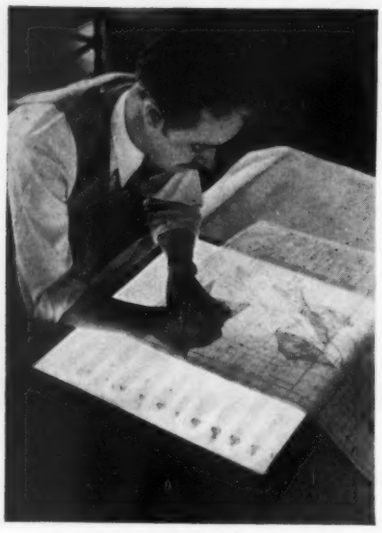
FIELD OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Tracing Speeded by Neon Light Table

By W. H. WISE
Los Angeles Department of Water & Light,
Los Angeles, Calif.

A neon light table, which introduces a new idea for the drafting room, has been designed by W. H. Wise, draftsman with the Bureau of Water Works and Supply, City of Los Angeles, Calif. The neon table is superior to the conventional type of table illuminated with incandescent lamps in that the blue light used is easy on the eyes and little heat is radiated; the temperature inside the illuminated chamber is only 98 deg. F. after continuous lighting for two hours. This unit gives 145 foot-candles of light, which is evenly distributed throughout the box, equal to 200 watts in the conventional type of light table, whereas the current used is only 75 watts.



The soft background of blue neon tubing facilitates tracing on this new drafting room table

The size of the neon light table used by the Bureau of Water Works and Supply is 31½x20x3¾ in. and weighs about 40 lb. Its illuminated surface measures 19½x21¾ in., the interior being painted a flat white. The neon unit consists of 21 feet of 12-mm. blue neon tube and one 7,500-volt, 30-milliampere luminous tube transformer.

The tube is shaped into a grid with 1¾-in. centers and placed ¼ in. below the plate glass. The transformer is partitioned off in the dark end of the table. No ventilation is provided for, since the amount of heat radiated is small. As a result, the interior is dirtproof.

•

Boosters Improve Rural Feeder Voltage

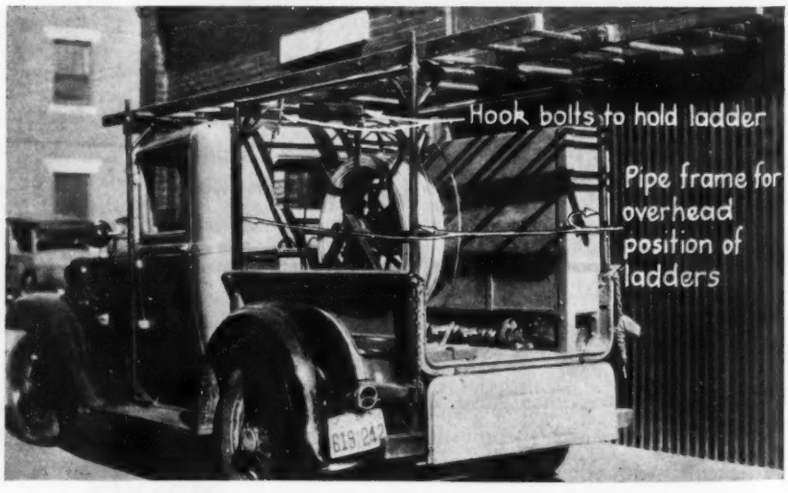
By C. A. POWEL
Central Station Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

In extending some of its distribution feeders into territory from which a smaller return on the investment can be expected the Clinton Electric Light & Power Company, Clinton, Conn., encountered the problem of satisfactory voltage regulation and the most economical way of obtaining it. The company's consulting engineer concurred in the proposed installation of both induction regulators and pole-type automatic boosters.

Voltage at the customers' entrances should be kept within 5 per cent of normal. With long, sparsely loaded lines where the investment must of necessity be kept low the more usual practice of increasing the size of conductor or duplicating facilities when the voltage regulation becomes bad is economically impossible. In many cases it is not even justifiable to carry a three-phase supply to some of the more remote consumers. The Clinton Company had such a line, which was originally three phase and 2 miles long, but which was extended single phase 4 miles.

The feeder consists of No. 4 copper conductors on both the three-phase and single-phase sections. The substation being supplied from a transmission line, the bus voltage varies somewhat, and this variation was reflected on the customer's services along the line. This naturally reduced the permissible voltage drop in the feeder if the customers at the end of the feeder were to receive satisfactory service and did not

Ladder Mounting Reduces Hazard



Mounting of ladders on the sides of service trucks imposes serious problems and hazards in parking and operating the cars. These objections are avoided by mounting them in an overhead position. A simple overhead pipe frame rack with welded connections supports the ladders and "J" bolts with wing nuts hold them securely in place, according to Carl R. Wenz, assistant superintendent of construction, Oklahoma G. & E. Co.

THESE DEMAND METERS AND DEVICES

give you all the facts you need

NO matter what your demand-metering problems are, General Electric offers a solution in its complete line of meters and devices.

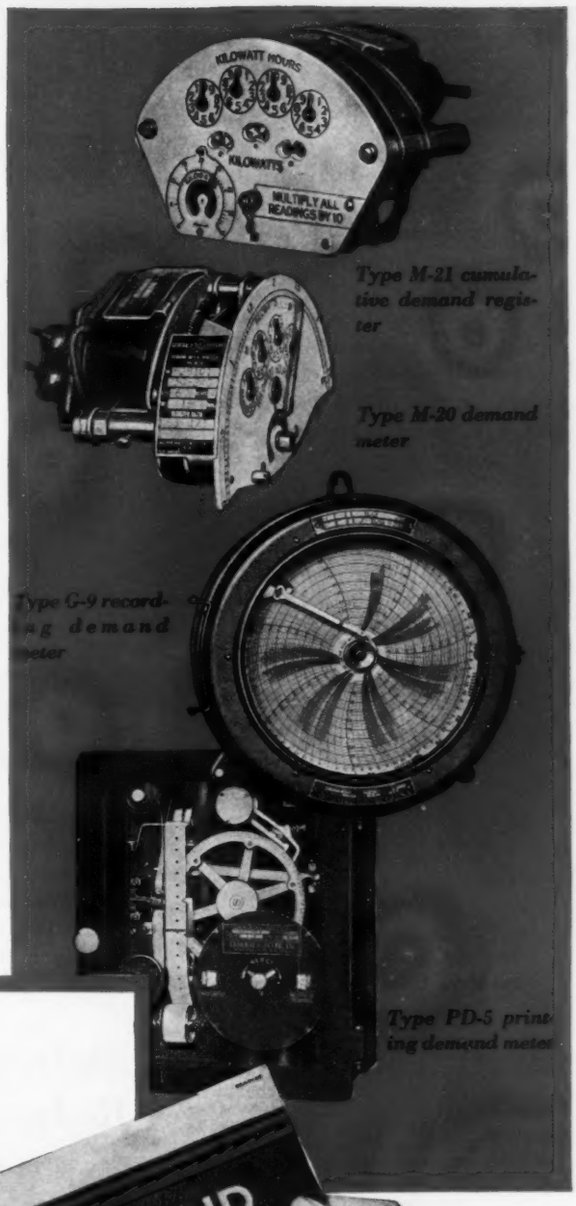
What Do You Require of a Demand Meter?

Do you need to know only the peak of the month? Or must you know when the peaks occurred, and have a definite record of the demands? Or do you need more comprehensive information as, for example, totalized demand?

The Answer

You can find the answer to these often-complex problems in the complete G-E line of demand meters. There are indicating watthour-demand meters and indicating or recording demand meters. In addition, there is complete equipment for totalizing demands and its associated problems.

Your nearest G-E specialist can suggest a practical solution for any of your metering problems. It will be based on the use of proved equipment which assures satisfaction. Ask him, or write General Electric Company, Schenectady, N. Y.



Type M-21 cumulative demand register

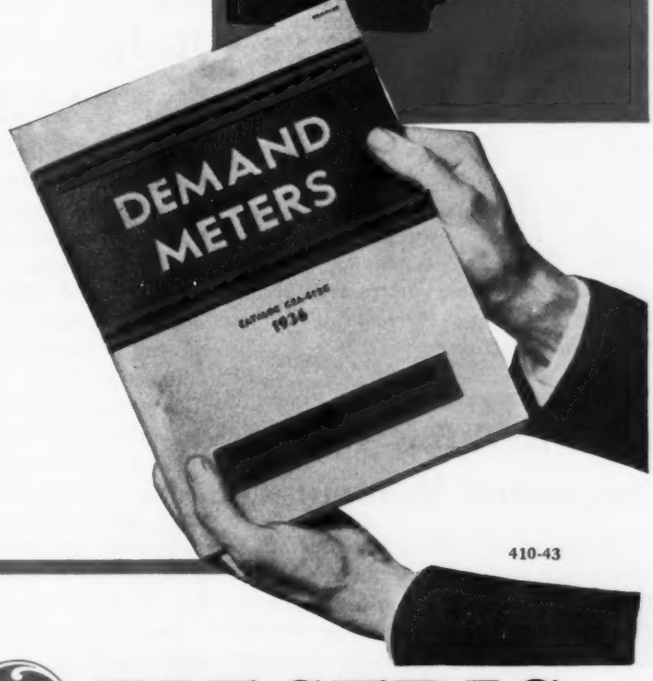
Type M-20 demand meter

Type G-9 recording demand meter

Type PD-5 printing demand meter

Complete Information

The new Demand Meter Catalog GEA-612C gives complete information on these meters. There is an enlargement of the listings of watthour-demand meters to include meters for combined power and lighting loads. A description of the new M-21 cumulative register together with listings of the register and corresponding watthour-demand meters is given. In addition, there's information on the new "Universal" rating of the M-20 and M-21 registers.

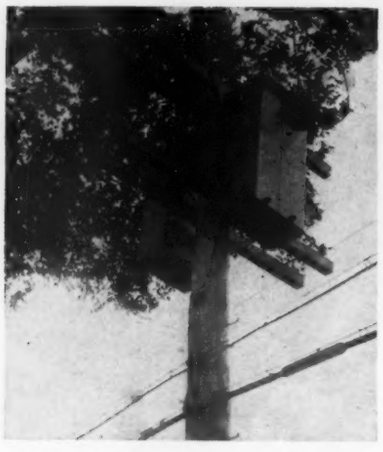


410-43

GENERAL ELECTRIC

permit full utilization of the investment in the line. It was decided, therefore, to install at the substation two single-phase induction regulators which would maintain, by means of a compensator, substantially constant voltage at the load center. At a point beyond the load center where the voltage drop attains its maximum permissible value a pole-type booster raises the voltage 10 per cent in two 5 per cent steps to compensate for the voltage drop along the rest of the circuit.

Calculations indicate that this will permit a considerable increase in the load on the original feeder for the same voltage drop, and the booster takes care of the extension without any sacrifice of load on the old part of the feeder. The last customer on the single-phase extension will receive about as good a service as the last one on the three-phase section.



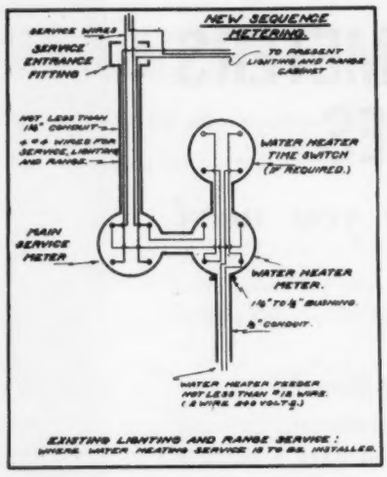
Booster auto-transformer has integral load tap-changer in two 5 per cent steps

Inclosed in a rectangular steel plate tank divided into two sections by means of an oil-tight steel barrier. Transformer is in one compartment and control mechanism in the other. Automatic operation is initiated by means of the same primary relay as is used with induction regulators. Relay controls a magnetically operated transfer switch.

•

Standard for New Sequence Metering

In converting existing services to the new sequence metering the Portland General Electric Company, Portland, Ore., has adopted standards which have proved both economical and flexible as well as being easily and quickly installed. In the accompanying diagram the wiring changes are shown for the conversion of an existing range and lighting service to the new sequence at the time provision is made for an off-peak water heater installation. Carrying the service leads back through the metal-clad installation to the existing panel from the load side of the meter greatly simplifies the changeover. Note that the water-heating service is taken from the line side of the meter. By using the weatherproof bayonet-type, side-outlet meter base a compact, easily accessible outdoor grouping of the meters and time switch is possible without adding materially to the cost of the metal-clad installation.



New sequence conversion

•

Shifted Transformers Reduce Plant Losses

By K. B. HUMPHREY
Sayreville, N. J.

Lighting for three sections of a large manufacturing plant was furnished by three 10-kva. transformers each located near its respective section. The actual distance between them was in the neighborhood of 500 ft., while the secondaries came very close to each other so that no difficulty was had in interconnecting them. Due to manufacturing conditions which had changed somewhat since the original installation it was found that each transformer was carrying about one-third load and, for long periods at a time, no load to speak of. The actual load then was about 10 kva., with little likelihood of an immediate increase.

One of the transformers was taken down and placed in storage, the two others relocated at a central point. Twenty-three-hundred volt cutouts of the disconnect type were placed in the primaries and the secondaries were run through safety switches to a common feeder, which in turn supplied the branch circuits for the different departments.

Under ordinary conditions only one transformer is operated. Each transformer of this size will have a core loss of about 60 watts, so that by cutting the number of transformers from three to one 120 watt-hours are saved any hour by this scheme. In a month this loss would mean 720 times 120, or 86,400 watt-hours per month, or about 86 kw.-hr. Besides the actual saving in kilowatt-hours due to an inexpensive rearrangement, higher efficiency was obtained and maintenance costs were reduced. Also, in case of trouble, the cause is more centrally located and easily fixed. There is no difficulty in running transformers in parallel if they are of the same make and type.

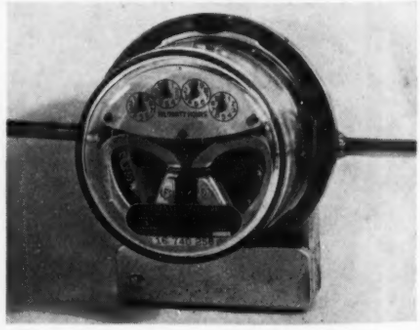
•

Meter Cover Wrench

By HOWARD D. RITTER
Meter Department, Detroit Edison Company

A special wrench which is proving very useful was designed to facilitate the loosening and tightening of glass covers on the new ABC line of standardized single-phase, watt-hour meter bases where a bayonet cover fastening device is used.

The jaw of the wrench is of steel and is made to conform closely to the contour of the rim. It extends over a large part of the circumference to minimize the stress on the glass. Steel handles are welded to opposite sides of the jaw. Metal projections fastened to the front of the jaw and resting on the cover rim prevent the cover from falling when lifted from the meter. A wrench may be made to fit any of the new type meters by cutting the jaw contour to conform to the shape of the cover rim.



No more struggling with meter covers

WHY STEEL SELECTS

G-E METAL-CLAD SWITCHGEAR WITH THE FAMOUS 255 OIL-BLAST BREAKER

1st IN PERFORMANCE
IN SAFETY
IN STEEL MEN'S CHOICE

1934 A hot-strip mill in Youngstown
1934 A cold-strip mill in Youngstown
1935 A blooming mill in Pittsburgh
1935 A hot-strip mill near Buffalo
1935 A cold-strip mill in the upper Ohio valley
1935 A hot-strip mill near Detroit
1935 A cold-strip mill near Baltimore
1936 A hot-strip mill in Pittsburgh
1936 A cold-strip mill in Pittsburgh
1936 A rod mill near Chicago
1936 A semicontinuous plate mill near Pittsburgh

All 500,000-kva metal-clad switchgear. All were shipped assembled—received complete, ready to operate.

G.E. BUILDS WITH STEEL

Here's the record on steel

WHEN the duty climbs to 500,000 kva, steel mills turn to the FKR-255C breaker in metal-clad switchgear to protect production. This decided preference for G-E metal-clad indicates a recognition that in its design, construction, and application the exacting requirements of real mill service have been given first consideration. General Electric, Schenectady, N. Y.

880-8

GENERAL ELECTRIC

POWER AT WORK IN INDUSTRY

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Large Load in New Crop Technique

Experiments conducted by Dr. W. F. Gericke of Berkeley, Calif., have resulted in the successful commercial application of a revolutionary method of plant growth. The new technique substitutes a heated nutrient liquid culture media for soils and appears to offer excellent possibilities with regard to the forcing of crops and out-of-season production. Fruits, vegetables and flowers have been cultivated experimentally with results that indicate both the potential yield per unit of area and the quality greatly exceeds the results from conventional growing methods.

The new technique is based upon the theory that an adequate supply of plant food should be made available under conditions most favorable for assimilation and plant growth. Nutrient elements essential to plant growth are supplied to water contained in concrete or redwood basins. On top of the basin is a wire screen covered with excelsior, peat moss or straw to prevent seeds from falling into the fluid. A supplementary covering of excelsior, straw or rice hulls is provided as a supporting medium for the young plants and insulation against heat losses through radiation. The nutrient liquid is heated by standard lengths of soil-heating cable and the various temperatures maintained in the solution during the majority of tests were between 75 and 85 deg. F. Ten or more elements are included in the nutrient liquid, all ingredients being products of the heavy chemical industries and available from natural resources.

In one commercial installation under the direction of Dr. Gericke tomatoes are grown in a double unit greenhouse 80x200 ft., containing 66 concrete basins 34 ft. long, 4 ft. wide and 6 in. deep arranged in two rows of 33 each. Each basin is heated by three 120-ft. lengths of G. E. soil-heating cable arranged in parallel across 220 volts, providing a total of 2,400 watts of heat per basin. Load charts showed that the energy consumption averaged approximately four hours per day, mostly during off-peak periods. By increasing the temperature of the liquid during the night hours so as to store heat, it is estimated that the entire load could be confined to off-peak hours with the attendant reduction in rates. This installation consumed approximately 30,000 kw.-hr. per month.

At this time only a limited number of commercial enterprises located over a fairly wide geographical distribution are being used to gain additional needed information. The ultimate development and significance of the liquid culture technique for crop production portends changes in certain phases of agricultural production and appears to open new markets for electrical equipment and service.

Greenhouse uses electrically heated nutrient liquid for growing tomatoes. Total connected load approximately 160 kw. served from main switchboard

•

Use Electric Heat to Reclaim Stoves

Part of the process involved in the reclamation of used gas ranges at the plant of the Acme Porcelain Enamel Company, New York City, calls for the removal of old enamel prior to re-enameling. This is done by immersing stove panels in a caustic sodium hydroxide solution for about seven hours at a temperature of 300 deg. F. Six 5-kw. electric immersion heaters arranged in the tank, as shown in the illustration, maintain the proper temperature within accurately controlled limits.

Electrically heated de-enameling tank showing location of heaters

A ton of sheet metal is prepared for re-enameling every 24 hours in the de-enameling tank, which in this case is 10 ft. long x 3 ft. 6 in. wide x 3 ft. deep. Five-inch block magnesia insulation is used in the side walls and tank cover. Elimination of fire hazard and accurate temperature control permit night loading and 24-hour operation.

The total connected load of the installation is 30 kw. Heaters are con-

SIMPLE PRACTICAL DESIGN

RUGGED CONSTRUCTION

FINEST RAW MATERIALS

COORDINATED PROTECTED BUSHINGS

CAREFUL WORKMANSHIP

SOLDERLESS CONNECTORS FOR ALL EXTERNAL CONNECTIONS

HIGH EFFICIENCY

AMPLE CLEARANCES

GOOD REGULATION

HIGH IMPULSE STRENGTH OF WINDINGS

L-M DISTRIBUTION TRANSFORMERS

Ask your L-M Salesman to show you the cut-away Transformer

—WRITE FOR CATALOG T-2

LM

LINE MATERIAL CO.

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

nected three-phase to a 208-volt circuit supplied from the lines of the New York Edison Company.

•

Electric Pumps Purify Lobster Pound

Working conditions have been vastly improved and purification of live storage assured at the lobster pound of the Willard-Daggett Company, Portland, Me., by an installation of salt water pumps operated on a long-hour basis upon Cumberland County Power & Light Company service. Formerly lobsters were held alive in floating tanks or "cars" at the surface of the harbor waters off the end of the wharf occupied by this house. Besides the hazards of contamination from local wastes, the discovery of dead lobsters was difficult and their handling was a hard task in cold weather. Today everything is accomplished indoors with a total energy consumption averaging not in excess of 10,000 kw.-hr. per month, including pumping, interior lighting, intermittent hoisting and a ¾-hp. exhaust fan in the boiling room. Labor requirements have been halved and the improvement in quality of the lobsters held for market has gone a long way in justifying the installation economically.

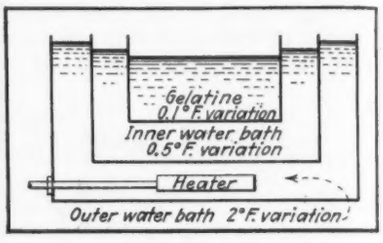
The storage room is about 50 ft. wide x 70 ft. long x 9 ft. high and contains 36 wooden tanks 16 ft. long x 5 ft. wide x 16 in. deep. Each has a capacity of 1,000 lb., or about 700 lobsters per tank. The tanks are mounted in two tiers and six rows, each being provided with two ¾-in. supply faucets and equipped with three 1¼-in. drains at the bottom. This enables the upper tanks to discharge into the lower ones either directly through the drain outlets or through overflow pipes about 12 in. high screwed into the outlets. The lower tanks drain into the harbor below the wharf. Continuous flow of salt water into the tanks is provided by two pumps which are equipped with intake lines drawing water from the bottom of the harbor at the end of the wharf and delivering it to the tanks by a cross-connected system of iron piping which has been found to give many times the life that copper has for this service.

The pumps are housed in a compartment at the end of the wharf. Each is a Deming centrifugal, capacity 200 gal. per minute against a maximum head of 100 ft. Direct-coupled motors provide the drive, each motor being a 10-hp., General Electric, three-phase induction outfit running at 1,720 r.p.m. on a 230-volt supply with Square D push-button control. Intakes from the harbor consist of a 4-in. pipe for each pump, tapered to a 2½-in. inlet, with 2-in. discharge and 3-in. mains leading to the tank room. City water provides the necessary priming. The auxiliary equipment includes a 500-lb. electric hoist with Robbins & Myers 1½-hp. motor and seventeen 60-watt lamps above the tanks. The temperature of the tank water normally ranges between 35 and 45 deg. F. The company handled 92,000 lb. of lobsters in March, and storage in these shallow tanks enables the condition of the shellfish to be easily observed at all times. While the former car floats had a capacity of 3,000 lb. each, inspection was difficult, replacement was necessary every two to three years and four men were required instead of two for handling.

Super-Close Heat Control

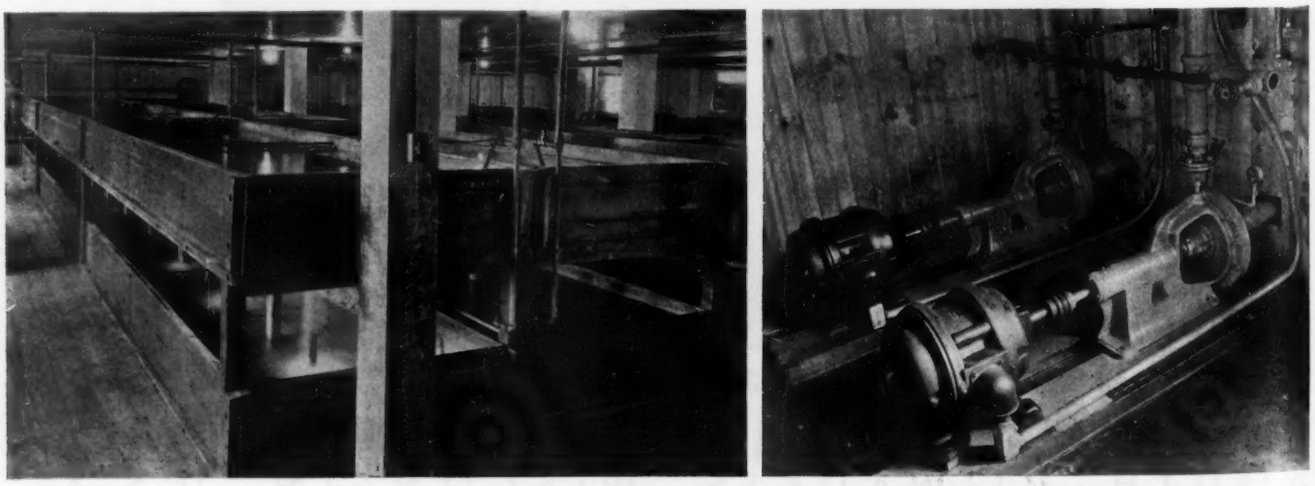
By H. R. STEVENSON
Detroit Edison Company,
Detroit, Mich

Manufacture of those gelatin boluses, by means of which people who "can't take it" are enabled to absorb desirable vitamins in cod liver oil, viosterol, and the like, is a very careful process. At the time that it is wrapped around the globule of oil the gelatine must be of exactly the right temperature; no pretty near nor almost can be allowed. In the plant of the Gelatine Products Company in Detroit accurate maintenance of the gelatine heat is accomplished with electricity, assisted by the cushioning effect of a double water bath.



Double water bath holds gelatine temperature

The gelatine container is of the form indicated in the accompanying sketch. The outer water bath contains the 15-kw. immersion type heater. Thermostatic control holds the temperature of this bath within 2 deg. F. The variation in the intermediate bath is held within half a degree and in the gelatine the temperature does not change more than one-tenth degree.



Left—Twenty-four-hour salt water flow preserves purity of shellfish in tanks served by electric pumps through double mains and branches. Right—Motor-driven pumps deliver pure salt water from harbor bottom to lobster pound.

ELECTRIFIED BREWERIES (Continued) (3)

The Brewing Process

(Adapted from industry studies by West Penn Power Co.)

Brewing of beer starts with crushed malt and cooked cereal. The enzymes of the malt convert the starch of the malt and cereal into sugars which are later converted into alcohol and carbon dioxide by fermentation.

1. *Malt Preparation*—Malt is barley which has been soaked and then allowed to germinate for about eight days. The sprouting is then checked by dry heat. Some breweries make their own malt, others buy it. The malt is ground as drawn from the hopper and passed into the mash tub.

   Malt Mill Ratings—A 200-bushel/hr. mill requires about a 10-hp. motor, a 300-bushel/hr., a 15-hp. motor (squirrel cage).

   Mfrs.—2, 17, 19, 42, 48, 77, 78, 95 (see Sheet No. 24).

   Conveyor and Malt Screen—Requires 10-15-hp. motor (squirrel cage).

   Mfrs. 2, 17, 45, 63, 78 (see Sheet No. 24).

2. *Cereal Cooking*—Corn grits or rice are cooked in steam-heated cooker (pressure cooker occasionally used) for about one hour. A common schedule involves 15-minute cooking at about 130° F. and then at 212° F. for 20 minutes. Water at 100° F. is then added to reduce temperature to 140° F. when passed into the mash tub. For coarse grits 1 bbl. (31 gal.) of water is used per 100 lb. of combined material in cooker; for refined grits 1 bbl. to 125 lb.; for rice, 1 bbl. to 75 lb.

   Cereal Cooker Ratings—Geared squirrel-cage motors are used to stir contents at 10-15 r.p.m. For 50 bbl. capacity, 3 hp.; for 200 bbl., 15 hp.; for 300, 25 hp.

   Mfrs.—16, 17, 41, 42, 48, 49, 64, 76, 77, 95 (see Sheet No. 24).

   Cereal Handling—Grain elevators take 5-15-hp. motors (squirrel cage) for either pneumatic or bucket type; screw conveyors take about 5 hp.

   Mfrs.—2, 17, 45, 63, 78 (see Sheet No. 24).

3. *Mash Tub*—The water (1 bbl. to 100 lb of malt)is stirred thoroughly while the malt is being added to form the mash. The temperature is held between 100-122° F., without stirring, for one hour, and meanwhile the enzyme peptase dissolves the undesirable albuminoids. It is then raised to about 153-157° F. before the cooked cereal is added. Stirring continues 10-15 minutes and then the temperature is raised to about 167° F.

   During the total time of about two hours the enzymes of the malt have inverted the cereal starches into maltose (fermentable sugars). The maltose passes with the water as *wort* into the brew kettle. The spent grain is removed and dried, or sold in moist form for cattle fodder or fertilizer.

   Mash Tub Rating—Geared squirrel-cage motors stir the mash; for 50-bbl. tub, 5 hp.; for 200-bbl., 20 hp.; for 300-bbl., 35 hp.

   Mfrs.—17, 41, 48, 49, 76, 77, 88, 95 (see Sheet No. 24).

   Grain Drier Rating—A grain drier requires about 7½ hp.

   Mfrs.—13, 81, 84 (see Sheet No. 24).

4. *Brew Kettle*—Filtered wort from the mash tub enters the brew kettle at 155-160° F. The temperature is raised to about 180° F. by a live steam jacket or coil and the wort is cooked for about one hour before adding hops from the hop bin. Cooking (up to 212° F.) and stirring continues for another hour or more after adding the hops to sterilize, flocculate and extract hops principles. Some breweries add hops at various intervals, ending with the highest grade of hops. Meters register the temperature, steam pressure, level of brew, etc.

   Brew Kettle Rating—Vertical-geared motors to give 20-40 r.p.m. are usually used. For 50-bbl. kettle, 5 hp.; for 100 bbl., 7½ hp.

   Mfrs.—4, 17, 18, 27, 42, 49, 51, 81, 95 (see Sheet No. 24).

ELECTRIFIED BREWERIES (4)

Partial List of Principal Manufacturers

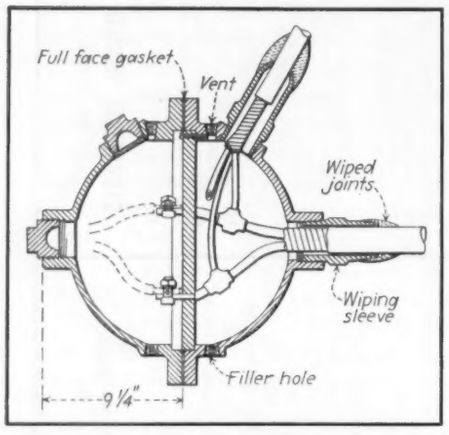
No.	
1	Air Reduction Co., 60 E. 42nd, New York City
2	Allis-Chalmers Mfg. Co., Milwaukee, Wis.
3	Allen Filter Co., Toledo, Ohio
4	Aluminum Co. of America, Pittsburgh, Pa.
5	Alvey Conveyor Mfg. Co., St. Louis, Mo.
6	Alvey-Ferguson Co., Inc., Cincinnati, Ohio
7	Amer. Engrg. Co., 2494 Aramengo Ave., Phila.
8	Amer. Perforator Co., 608 W. Jackson Blvd., Chicago
9	Amer. Steam Pump Co., Battle Creek, Mich.
10	Ludwig Baer, 50 Union Square, New York City
11	Baker Ice Mach Co., Omaha, Neb.
12	Barry-Wehmiller Mach. Co., St. Louis, Mo.
13	C. O. Bartlett & Snow Co., Cleveland, Ohio
14	Bastian-Blessing Co., 240 E. Ontario, Chicago
15	Beach-Russ Co., 50 Church St., New York City
16	Bishop & Babcock Sales Co., Cleveland, Ohio
17	Blaw-Knox Co., Pittsburgh, Pa.
18	Buffalo Foundry & Mach. Co., Buffalo, N. Y.
19	Buhler Bros., Inc., 330 W. 42nd, New York City
20	A. M. Byers Co., Pittsburgh, Pa.
21	Carbondale Mach. Co., Carbondale, Pa.
22	Carrier Engrg. Corp., Newark, N. J.
23	Chain Belt Co., Milwaukee, Wis.
24	Chicago Pump Co., 2336 Wolfram St., Chicago
25	Clark Tructractor Co., Battle Creek, Mich.
26	Cleveland Union Engrg. Co., Cleveland, Ohio
27	Columbian Steel Tank Co., Kansas City, Mo.
28	Cons. Products Co., Inc., 16 Park Row, New York
29	Crown Cork & Seal Co., Baltimore, Md.
30	Dayton-Dowd Co., Quincy, Ill.
31	DeLa Vergne Engine Co., Philadelphia, Pa.
32	Deming Co., South Bdwy., Salem, Ohio
33	Detroit Pump Co., Detroit, Mich.
34	Dostal & Lowey Hydro Co., Milwaukee, Wis.
35	Economy Pumping Mach. Co., 3431 W. 48th, Chicago
36	Eick, Otto, Inc., St. Louis, Mo.
37	Elliott Co., Jeannette, Pa.
38	Enzinger Union Corp., Buffalo, N. Y.
39	Eureka Machine Co., 2603 Vega Ave., Cleveland
40	Fairbanks Morse & Co., Chicago, Ill.
41	Ford Brothers Co., Philadelphia, Pa.
42	Freyn Engrg. Co., 310 S. Michigan, Chicago,
43	Frick Co., W. Main St., Waynesboro, Pa.
44	Frigidaire Corp., Dayton, Ohio
45	Fuller Co., 180 Bridge St., Catasauqua, Pa.
46	Gardner-Denver Co., Quincy, Ill.
47	General Elec. Co., Nela Park, Cleveland
48	General Mchry. Co., 1709 Logan St., Cincinnati
49	General Tank Co., Harrison Ave., Kearny, N. J.
50	Goulds Pumps, Inc., Seneca Falls, N. Y.
51	Graver Tank & Mfg. Co., East Chicago, Ind.
52	Grinnell Co., Inc., Providence, R. I.
53	Harnischfeger Corp., Milwaukee, Wis.
54	Hobart Bros. Co., Troy, Ohio
55	Ingersoll-Rand Co., 11 Broadway, N. Y. C.
56	Internat'l Conveyor & Washer Corp., Detroit
57	Jeffrey Mfg. Co., 900 N. 4th St., Columbus, Ohio
58	Karl Keifer Mach Co., Cincinnati, Ohio
59	Kelvinator Corp., Detroit, Mich.
60	Lamson Co., 3100 James St., Syracuse, N. Y.
61	Lincoln Electric Co., Cleveland, Ohio
62	Linde Air Products Co., 205 E 42nd, New York
63	Link-Belt Co., 910 S. Michigan, Chicago
64	Littleford Bros., 438 E. Pearl, Cincinnati
65	Liquid Carbonic Corp., 3100 S. Kedzie, Chicago
66	Loeb Engrg. & Sup. Co., 518 W. Lake, Chicago
67	Logan Co., 1115 Franklin St., Louisville, Ky.
68	Mathews Conveyor Co., Ellwood City, Pa.
69	Maynz & Co., 1775 Broadway, Chicago
70	McKenna Brass & Mfg. Co., Ferst Ave., Pittsburgh, Pa.
71	Meyer, Geo. J. Co., Layton & Holthoff, Cudahy, Wis.
72	Nash Engrg. Co., South Norwalk, Conn.
73	Oliver United Filters, Inc., 33 W. 42nd, New York City
74	Quimby Pump Co., 338 Thomas St., Newark
75	Rauh, Robt., Inc., 490 Frelinghysen, Newark
76	Sexton Co., 4707 Broadway, Chicago
77	Shock, Gusmer & Co., Hoboken, N. J.
78	Sprout Waldron & Co., Inc., Muncy, Pa.
79	Standard Conveyor Co., North St., St. Paul, Minn.
80	Standard Knapp Corp., Long Island City, N. Y.
81	Struthers Wells Co., Warren, Pa.
82	Taber Pump Co., Buffalo, N. Y.
83	Thomson Gibb Elec. Welding Co., Lynn Mass
84	Union Standard Equipment Co., 320 Lafayette St., N. Y.
85	Union Steam Pump Co., Battle Creek, Mich.
86	U. S. Bottlers Mchry. Co., Chicago, Ill.
87	Viking Pump Co., Cedar Falls, Iowa
88	Henry Vogt Mche. Co., Louisville, Ky.
89	Westinghouse Elec. Mfg. Co., E. Pittsburgh Pa.
90	C. H. Wheeler Mfg. Co., Philadelphia, Pa.
91	Worthington Pump & Mchry. Corp., Harrison, N. J.
92	Yale & Towne Mfg. Co., Philadelphia, Pa.
93	York Ice Mchry. Corp., York, Pa.
94	Zahm & Nagel Co., Inc., 74 Jewett Ave., Buffalo, N. Y.
95	Zobler Otto Mfg. Co., Chicago, Ill.
96	Zoller, Chas. Inc., 205 Prince St., New York City

NEW ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

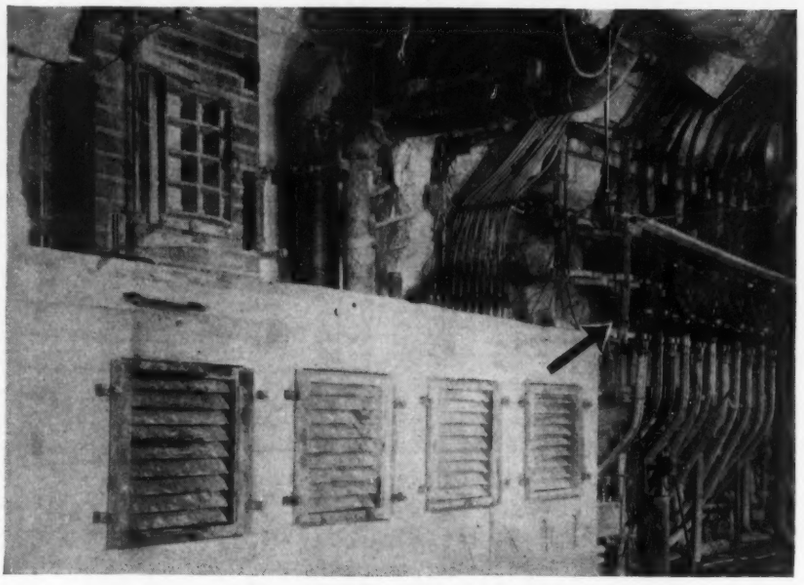
Simple Junction Box Houses Tunnel Cable

Subterranean waters encountered in driving the San Jacinto tunnel of the Metropolitan Water District's aqueduct from the Colorado River to Los Angeles necessitated the installation of two underground pumping stations at either end of the shaft. The rooms housing the electric pumping units are at tunnel elevation and have been made as watertight as possible. Sump pumps are supplied to take care of any seepage that might occur.



Essential part of the watertight junction box used by Metropolitan Water District engineers in San Jacinto Tunnel

Since it was essential that the electrical installation be completely reliable in order to insure that the pumps will operate even when the tunnel is flooded and that the 800-ft. shaft to the surface is filled with water, power taken from a sectionalized double bus at the surface is supplied through mine-type cables suspended in the shaft. The cables terminate in new-type, bomb-shaped junction boxes developed by M.W.D. engineers. These junction boxes are spherical in shape and are in the form of two hemispherical castings, as shown in the diagram. Mine cables terminate in the upper halves of the boxes in wiped joints. The space between the casting and the end of the armored cable is made watertight by wrapping with tape, painting with rubber cement and varnishing, the entire sleeve thus formed with several coats of waterproof varnish. Three conductors within the junction boxes are fanned out and spaced by passing through holes



Junction box installation in the San Jacinto Tunnel of the Metropolitan Water District

The watertight door leading through the concrete plug into the pump chamber can be seen on the left.

Sky Hooks, No Joking

Look twice and then have a chuckle. The pole which was, was right in line with the trench for Highland Falls' new sewer. W. A. Kehl, superintendent of the Orange & Rockland Electric Company, Monroe, N. Y., avoided interruptions by sawing out the middle section of the pole and hanging the business part by four guys from something in the neighborhood, probably some sisterly poles. Anybody that ingenious will probably weld the timber back in place later.

The Manufacturer's Bulletin Page

KEARNEY
Hi-Line Equipment News

NEW PRODUCT INFORMATION

Advertising Page | St. Louis, Mo., July 18, 1936 | World Copy

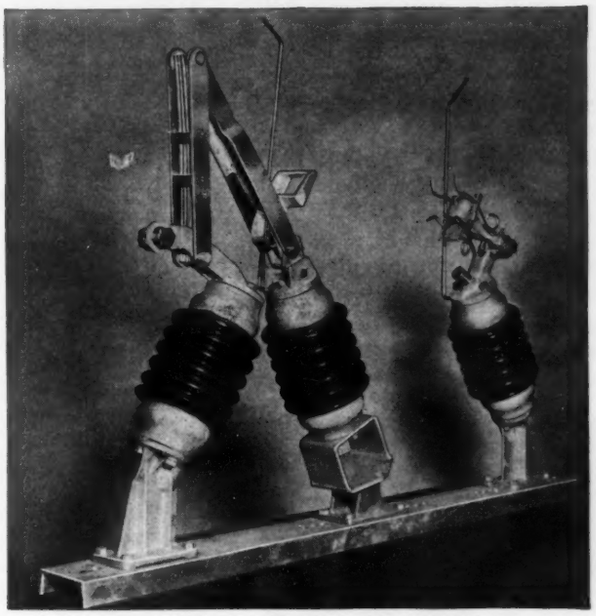
POINT PRESSURE CONTACTS INCORPORATED IN KEARNEY GANG SWITCH PANTOGRAPH

Station Post Insulators Used To Overcome Objections of Loose Insulator Pins That Are Causing Radio Interference

OF INTEREST to many operating men is the use of point pressure contacts, both in the pantograph and the switch contact proper of the Kearney Pole Top Switch, here shown.

Point pressure in the pantograph has been accomplished by "riding" a group of Copperweld rods, under proper pressure, on either side of the hinge pins. The two sketches below diagramatically explain the action.

This affords multiple contacts which carry the rated load of the switch without excessive heating and permit the elimination of the use of either braid, cable or laminations which many operators have considered a source of trouble.



PANTOGRAPH OF SWITCH IN OPEN POSITION

Figure 1 shows a diagramatic view of the contact rods in the pantograph and their relation to the hinge pin when the switch is in closed position.

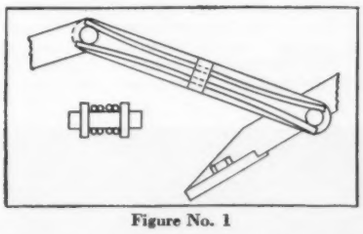


Figure No. 1

Figure 2 shows the switch in open position with contact rods still riding, under proper pressure, on the pantograph hinge pin. The photograph at the top of this page is a switch unit with Station Post Insulators which is 200 ampere, 23,000 volt rating.

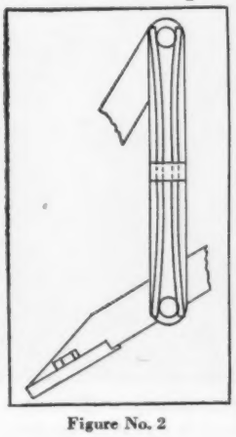
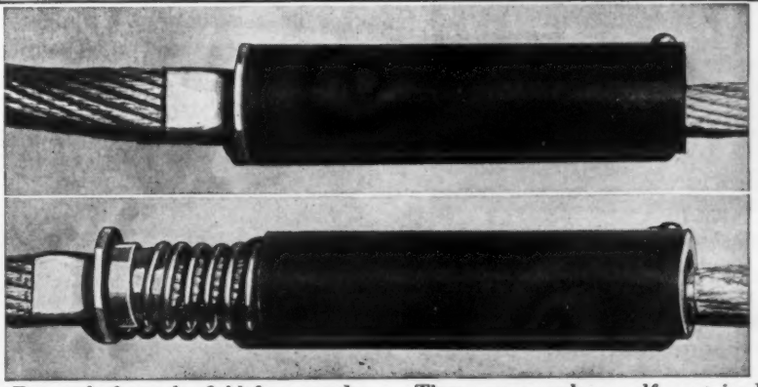


Figure No. 2

A NEW LINE OF SECONDARY FUSES NOW AVAILABLE IN RANGE OF SIZES



Demands from the field for secondary fuses which will permit isolation of service entrance faults, give transformer secondary protection and permit secondary banking prompted the development of this new line of Kearney Secondary Fuses.

These fuses have performance characteristics as specified in N.E.M.A. standard 100% basis of rating and current characteristics similar to Kearney Quik-Action Links.

They are complete, self contained units with outer tube made of bakelite to resist weathering and the inner tube made of fibre to give arc extinguishing properties.

The spring which actuates separation of the line and clearly indicates the operation, in open position, is made of stainless steel. Pure tin is used for fusible elements.

For further information and prices—

JAMES R. KEARNEY CORPORATION
4224 Clayton Avenue ST. LOUIS, MO.

drilled in the insulating partition between the two spherical halves. The ends are spliced into three conductors of a lead-covered cable which is wiped into the lower half of the junction box, the two halves of the box then being assembled and the box filled with compound. The lead-covered cable is carried in conduit running through the concrete plugs sealing the pump chamber from the tunnel upward. Conduit runs are sealed off to make them watertight also.

•

Weather to Order From Aging Machine

By GEORGE A. POSNER
Los Angeles, Cal.

Fog, rain, windstorm or desert heat can be produced at will within the confines of a mechanical-electrical weather-maker devised to eliminate the element of chance in the selection of

Machine duplicates weather conditions for aging tests

equipment subject to deterioration from exposure to weather. The device, known as the "Weather-Ometer," was used by the Bureau of Water and Power of the City of Los Angeles in selecting the equipment and materials used in the transmission line from Boulder Dam. Since this line traversed deserts, snow-capped mountains and moist lowlands, materials were necessarily subjected to tests covering a wide range of weather stresses.

By intensifying the action of weather in this unit will produce within a few days the equivalent effects of months of outdoor service. Sunlight is simulated by a violet carbon arc in a glass globe mounted within a revolving drum. Light is intensified by convex lenses and amplifiers. Temperature and humidity of the atmosphere around the specimens mounted in the drum may be regulated by means of temperature control, water spray, water pan and ventilating fan. A number of combinations from a mild drizzle to a driving rainstorm can be produced.

Comparison of the samples at intervals or by figuring "Weather-Ometer" time as compared to natural time at a known ratio enables the tester to obtain a good idea of the comparative quality of the materials under test, or the nature and extent of their possible failure.

•

Photo-Cell Recorder Measures Motor Slip

By R. L. WITZKE
Research Assistant,
Electrical Engineering Department,
State University of Iowa

An oscillographic record of induction motor slip is obtained by means of the device shown in the accompanying illustrations. The recorder employs two similar disks. For an 1,800-r.p.m. induction motor speed the disks should contain 30 holes each, equally spaced around a circle. One of the disks is mounted on the end of the shaft of the induction motor under test and the other on the shaft of a synchronous motor having a speed equal to the synchronous speed of the induction motor.

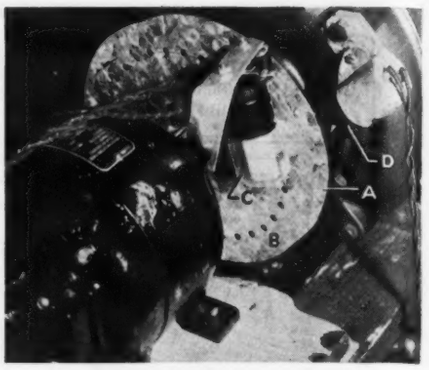


Photo-cell slip recorder

A photo-electric cell (*C*) is placed in such a position that it receives light from a lamp (*D*) through the holes in the disks. Since the speed of disk *A* is less than the speed of disk *B*, because of the slip of the induction motor, a light impulse will reach the photocell for each 1/30 revolution that the induction motor drops behind the synchronous motor. The time between light impulses, or the time required for 1/30 revolution of slip, can be read from the voltage or current waves which are also recorded on the oscillogram. If this time, in seconds, is denoted by *t*, the slip of the induction motor is $60/30t$ or $2/t$ r.p.m.

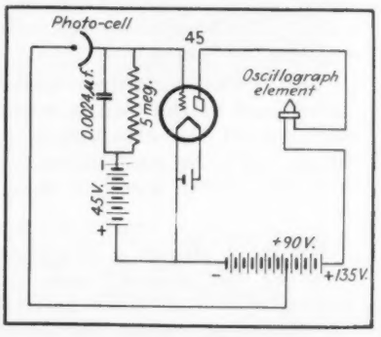
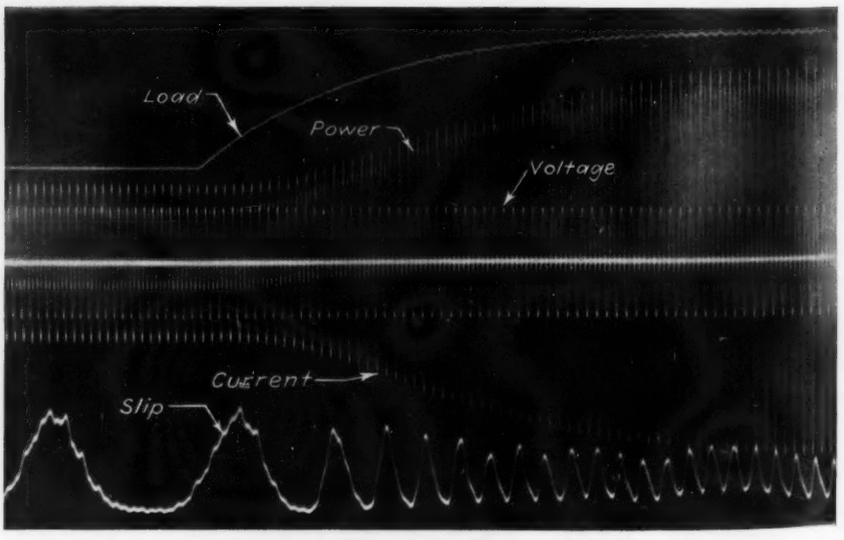


Photo-cell amplifying circuit

The photo-cell output is amplified by means of this simple vacuum-tube amplifier. An oscillograph element placed in the amplifier plate circuit records the light impulses.



Oscillogram compares slip with load

The lower graph is the slip record when load is suddenly applied to an induction motor. In this case the slip varied between 5.4 and 60 r.p.m. For lower ranges of slip the number of holes in the disks should be increased, and for larger values of slip the number should be decreased.

BUILDING UP THE LOAD

New ideas and practices in selling electrical equipment and service to industrial, commercial and domestic customers

Auxiliary Keeps Range on the Line

Load builders and engineers of the California Oregon Power Company consider the electric range to be a profitable load only if the range is used to cook the family's meals 365 days out of the year. Out in this territory, however, it was found that more than 75 per cent of the homes served were without central heating plants and depended upon fuel-burning stoves.

Thus, in many cases where a modern electric range was installed beside one of these fuel-burning stoves, the customer who started up his stove for heating purposes would quite naturally cook on the stove also. Annual revenue from the electric range was halved for this reason, and even when combination fuel and electric ranges were installed, the electric range revenue was cut by about 25 per cent.

To meet the problem Vice-President Glenn Jackson of the California Oregon Power Company offers the customer the small, efficient, fuel-burning heating unit shown in the accompanying illustration beside an electric range. The unit developed by Mr. Jackson is of the natural circulating type with an inner shell surrounded by an enamel housing. There is no cooking surface on this auxiliary unit, but it does contain hot water coils so the customer may have hot water service, as well as heating, from this unit.

Two thousand of these auxiliary heaters, shown beside the electric range, sold by California Oregon Power Company in the past eighteen months

•

How Air Conditioning Has Grown in Chicago

By WILLIAM P. ROCK
Commonwealth Edison Company*

In 1933 the Commonwealth Edison Company established a separate division to handle air conditioning. In Chicago installations made prior to 1933 air conditioning of all descriptions was represented by 28,000 hp. connected load. Activity during 1933 added 2,700 hp. In 1934 another 6,800 hp. was added, which was more than double the horsepower added in 1933. In 1935 new installations added 5,461 hp. By the end of 1935 the total horsepower for this class of business was 48,942 as represented by 934 separate installations. Investigation of customers' bills has shown us that the annual income per horsepower from air conditioning averages $12. Therefore, our yearly income due to this new industry has been built up to $600,000.

*From paper to Great Lakes Power Club.

Today more than 50 per cent of all theaters in Chicago are air conditioned. Restaurants are next in percentage saturation with 4 per cent. All other classifications are only fractions of 1 per cent saturated. With this great market ahead for new air conditioning and with more than half a million dollars yearly income already on our lines, and having increased our air conditioning load in three years' time by 75 per cent, it is apparent that the time is not distant when millions of dollars annually will be coming from this air-conditioning load.

New installations in 1935 include 51 restaurants, 31 theaters, 28 clothing stores, 61 private offices, 31 general offices and 24 residences. Very encouraging have been the acceptance of new classes of business this year. Air-conditioned beauty shops have more than doubled; so have doctors' offices, candy stores, drug stores and undertaking establishments.

•

Civic Pride Enlisted to Boost Home Usage

Civic pride has been enlisted by the Georgia Power Company in a novel way to develop the use of electricity in Georgia homes. With only a little more than five months elapsed since the inauguration of the "Home Town Electrical Contest," a lively interest is already being demonstrated by the progress in some 270 cities and towns in the state.

The aim of the contest is to increase the average usage of electricity in the homes of every community in Georgia by offering prizes to the towns which make the best showing in one year in their particular population class. For this purpose the communities have been divided into four groups: A, having more than 400 residential electric customers; B, 200-400; C, 100-200; D, 25-100. Groups A and B are offered three prizes each, while groups C and D are offered six prizes each. Each group of prizes totals $2,250. In addition there are two special sweepstake prizes of $750 and $250 for the

FREE ADVICE FOR HOME OWNERS

Citizens of Portland, Ore., cannot plead the excuse of ignorance for not having modern kitchens since the Portland General Electric Company has instituted a free Kitchen Planning Home Service in the attractive quarters shown above. Advice and information on kitchen arrangement and equipment are dispensed by competent home economists in the same friendly manner that characterizes this utility's dealings with all of its customers.

two communities, regardless of group, attaining the highest average usage.

By the group prizes small communities are not forced to compete with larger cities.

Another feature of the contest is that the contest "point scores" are figured on increase of average usage as well as average usage. Hence the community which has a low average now and shows a large increase has just as much chance of winning as a city with a high average but a lower increase. In fact, increase of use receives the greatest credit, as ten points is awarded for each kilowatt-hour increase of average usage, whereas one point is awarded for each kilowatt-hour of average consumption.

There are no restrictions on the use of the prize moneys, except that they be devoted to civic improvement, charity or educational projects. Prizes won will be dispensed by committees composed of representative citizens appointed by local mayors and councils. As of February 1, the group ranked as follows for average consumption:

A, 14 out of 19 towns had 1,000-1,695 kw.-hr.; B, 24 out of 30 had 1,000-1,617; C, 36 out of 60 had 1,000-2,097; D, 42 out of 163 had 1,000-2,038. Based on point scores (1 point for each kilowatt-hour of average consumption plus 10 points for each kilowatt-hour increase), the standing by group was A, 6 out of 19, 2,000-2,887; B, 10 out of 30, 2,000-2,910; C, 21 out of 60, 2,000-3,264; D, 20 out of 163, 2,000-3,446.

In other words, one-third of the communities in each of the first three groups had attained scores of 2,000 or greater, while one-eighth in group D towns (25-100 population) had accomplished as much. Ten communities had reached average consumptions of 1,600 kw.-hr. or better:

Avondale Estates, 2,097; Louisville, 2,039; Woodbine, 2,038; Warm Springs, 1,894; Manchester, 1,816; Perry, 1,770; Tifton, 1,695; Baconton, 1,687; Darien, 1,625; Baxley, 1,617.

It is interesting that these high usages were, with one exception, reached in towns having less than 400 residential customers.

The largest increases in annual kw.-hr. usage per residential customer were obtained by three small towns having less than 200 residential customers, namely, Chipley 188.5 kw.-hr. increase, Ochlochnee 186.9, Reidsville 174.5.

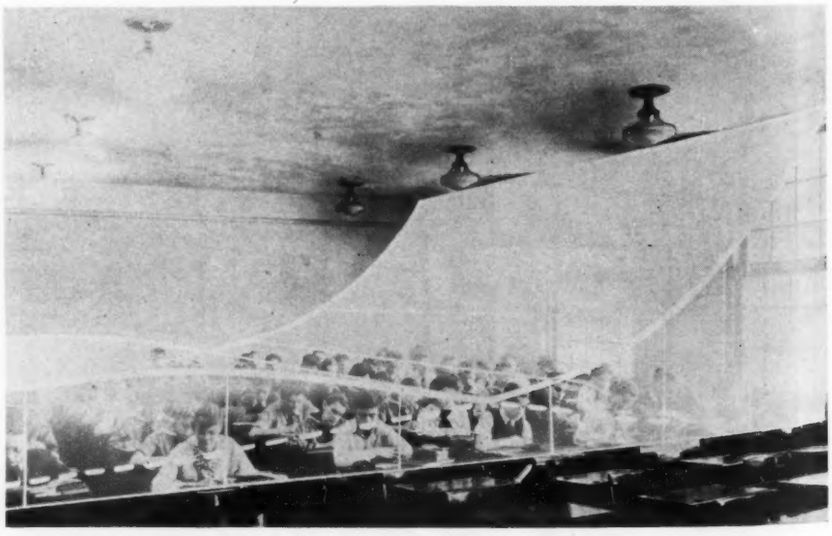
Newspaper editors in all parts of the state are encouraging their respective communities to compete for the prizes. The contest ends October 31, 1936.

•

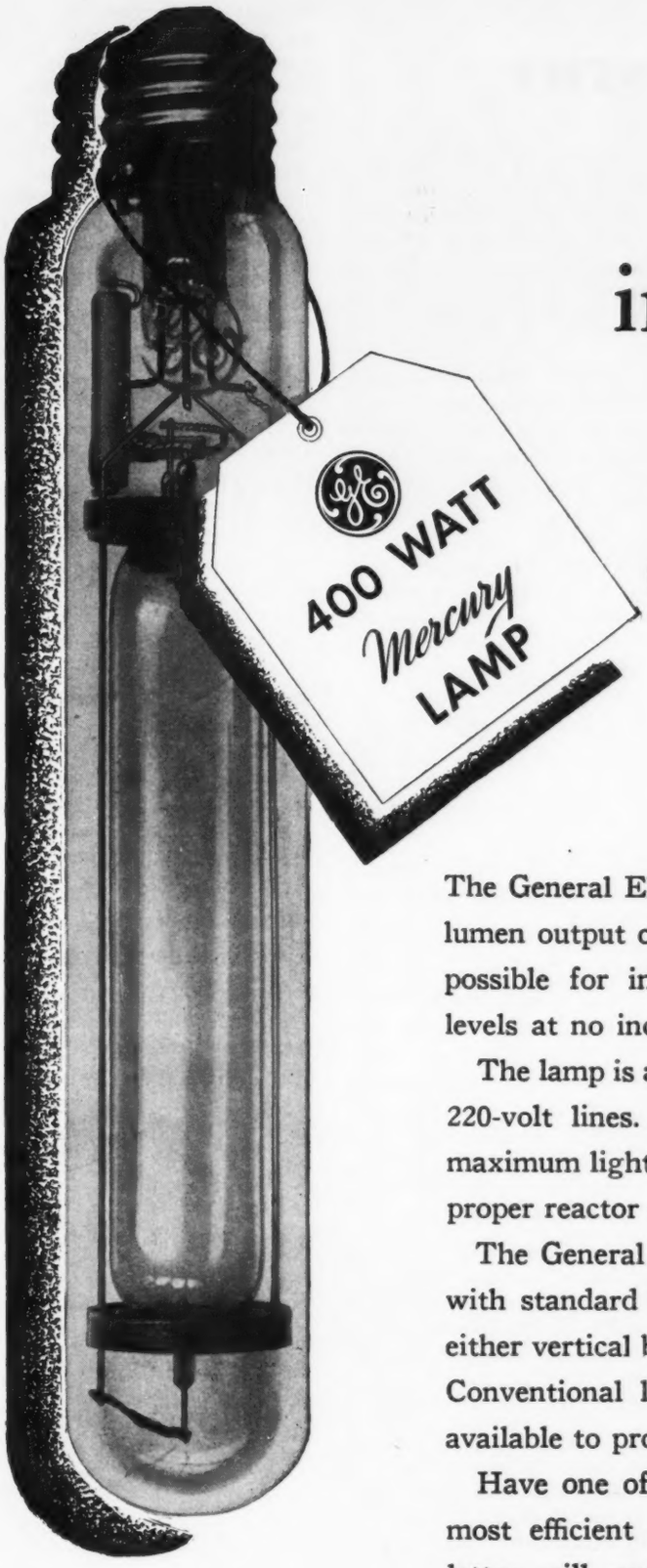
Supplement Daylight in Modern Classrooms

By WALTER STURROCK
General Electric Company,
Nela Park, Cleveland, Ohio

Certain minimum ratios of window to floor area have been stipulated for offices and school rooms to provide students with the greatest amount of daylight practicable. There still exists, however, a need for supplementary artificial illumination. This need is based on several considerations. Statistical abstracts of the United States reveal that during the ten months of the school year the percentage of possible sunshine amounts to only 59 per cent. Of even greater importance is a consideration of the daylight intensities in the classroom. The accompanying illustration brings out graphically the point that natural lighting falls off rapidly as distance from windows is increased and should therefore be supplemented by artificial lighting in order to insure that illumination is constant in quality, favors no classroom locations and handicaps no student in his seat location.



Daylight supplemented by artificial light to give proper classroom illumination
Students in front row of seats are provided with light meters. Meter readings superimposed on picture show illumination range from 5 to 90 ft.-candles with room lights off and from 18 to 100 with them on.



Buy industry's most efficient lamp

The General Electric Mercury Lamp, with its lumen output of 16,000 at 400 watts, makes it possible for industry to double its lighting levels at no increase in current costs.

The lamp is adapted for use on either 110- or 220-volt lines. Most efficient operation with maximum light output is assured by use of the proper reactor or transformer.

The General Electric Mercury Lamp comes with standard Mogul screw base, adapted to either vertical base-up or base-down mounting. Conventional luminaires of proper types are available to provide efficient light distribution.

Have one of our engineers recommend the most efficient application for your needs. A letter will receive our immediate attention.

Order your auxiliary devices which were designed especially for this lamp from the General Electric Vapor Lamp Company.

GENERAL ELECTRIC

672H

General Electric Vapor Lamp Co.
805 Adams Street, Hoboken, N. J.

Incandescent Lamp Department
Nela Park, Cleveland, Ohio

MEN OF THE INDUSTRY

Honorary Degree Is Conferred on John E. Zimmermann

John E. Zimmermann, president of United Gas Improvement Company, was awarded the honorary degree of doctor of laws recently by Villanova College. The citation ran as follows: "Distinguished engineer and prominent industrialist, director in many public utility

corporations, your native ability, courage and perseverance have won for you an ever-increasing measure of recognition from your associates. Fully aware that outstanding success in life's battle has not made you unmindful of your fellow men, Villanova deems it a great pleasure to award you her honorary degree of doctor of laws."

•

► MARTIN LYON, Clintonville, was elected president of the Wisconsin Municipal Utilities Association at its recent annual convention.

► SERGE SEMENKO, vice-president of the First National Bank of Boston, has been elected a director of the Electric Power & Light Corporation.

► JAMES W. CAMMACK, JR., of Owenton has been appointed acting chairman of the Kentucky Public Service Commission by Governor Chandler to succeed J. C. W. Beckham, resigned.

► ALFRED C. MARSHALL, vice-president and general manager of the Detroit Edison Company, has been elected the only Detroit director of the Michigan state Chamber of Commerce.

► H. HENDERSON has been appointed rate engineer of the Iowa Electric Light & Power Company to fill the vacancy created by the death of Charles Dauchy. Mr. Henderson will also act as secretary of the Iowa Public Utilities Association. Following graduation from Iowa State College in 1925 Mr. Henderson started to work for the Iowa Electric Company doing valuation work. He was shortly transferred to the Iowa Railway & Light Corporation, where he has continued with the accounting department in property accounting and valuation.

► J. W. JOHNSON, formerly engineer with the Federal Power Commission in Washington, has been employed by the city of Florence, Ala., as superintendent and general manager for the new T.V.A. system.

► HARRY E. CARSON, district engineer of the New England Power Engineering & Service Corporation, Worcester, Mass., has been elected chairman of the Worcester section of the American Institute of Electrical Engineers.

► REX I. BROWN, president of the Mississippi Power & Light Company, has been named a delegate to the World Power Conference. He will represent the Jackson, Miss., Chamber of Commerce.

► D. M. JOHNSON of the British Columbia Electric Railway Company has been elected chairman of the Vancouver branch of the American Institute of Electrical Engineers. Election took place at the recent annual dinner and Mr. Johnson will take over the duties of his new office on August 1.

► GAY H. BROWN of Utica, formerly Supreme Court Justice, has been appointed counsel to the New York Public Service Commission. The position has been vacant since Col. Charles G. Blakeslee resigned last April.

► LELAND OLDS, secretary of the New York State Power Authority, has been named a member of the commission of three appointed by President Roosevelt to travel throughout Europe to study co-operative enterprise as it exists abroad.

► WILLIAM L. C. LANG, supervisor of merchandise sales, Delaware Power & Light Company, was recently elected president of the Electrical Trades Association of Wilmington. Mr. Lang is the first utility man to be selected for that office. He has been supervisor of merchandise sales in Wilmington since 1931.

► O. R. TOMAN of Hastings, Neb., has been appointed general manager and chief engineer of the Lancaster County rural public power project. For the past year Mr. Toman had been assistant electrical manager of the Tri-County project and for sixteen years prior to that was an engineer with the Iowa-Nebraska Light & Power Company, working in Iowa, Missouri and Nebraska.

► ANDREW W. BRADT, chief engineer of the Hamilton Hydro-Electric System, Hamilton, Ont., has been appointed general manager of the system and secretary of the Hamilton Hydro-Electric Commission, to succeed the late W. H. Childs. Mr. Bradt began his electrical career with the Dominion Power & Transmission Company, which originally supplied Hamilton. He left that utility in 1908 to join the Portland (Ore.) Railway, Light & Power Company, but returned to Hamilton in 1912 and has since been with the Hamilton Hydro.

► CLINT HARRISON has been appointed by Gov. Bibb Graves a member of the Alabama Public Service Commission to succeed Frank P. Morgan, who resigned recently to enter the Interstate Commerce Commission's new motor carrier's bureau at Atlanta.

► JOHN J. MURRAY, chairman of the Massachusetts Public Utilities Commission, has been elected chairman of the Association of New England Utilities Commissioners. ALLAN BROOKS, executive secretary of the Massachusetts commission, has been elected secretary of the New England Association.

•

Harold Green in Charge of New Training Program

Harold H. Green, director of market research for the Incandescent Lamp Department of the General Electric Company, will be in charge of the new sales

training program for commercial and lighting salesmen. The course is designed for salesmen of utilities as well as salesmen of electrical wholesalers and electrical contractors and is expected to be available August 1.

•

► J. A. MACINTYRE has been appointed chief engineer at the Office of Works by the British First Commissioner of Works. Mr. Macintyre is an authority on illumination and air-conditioning problems. He

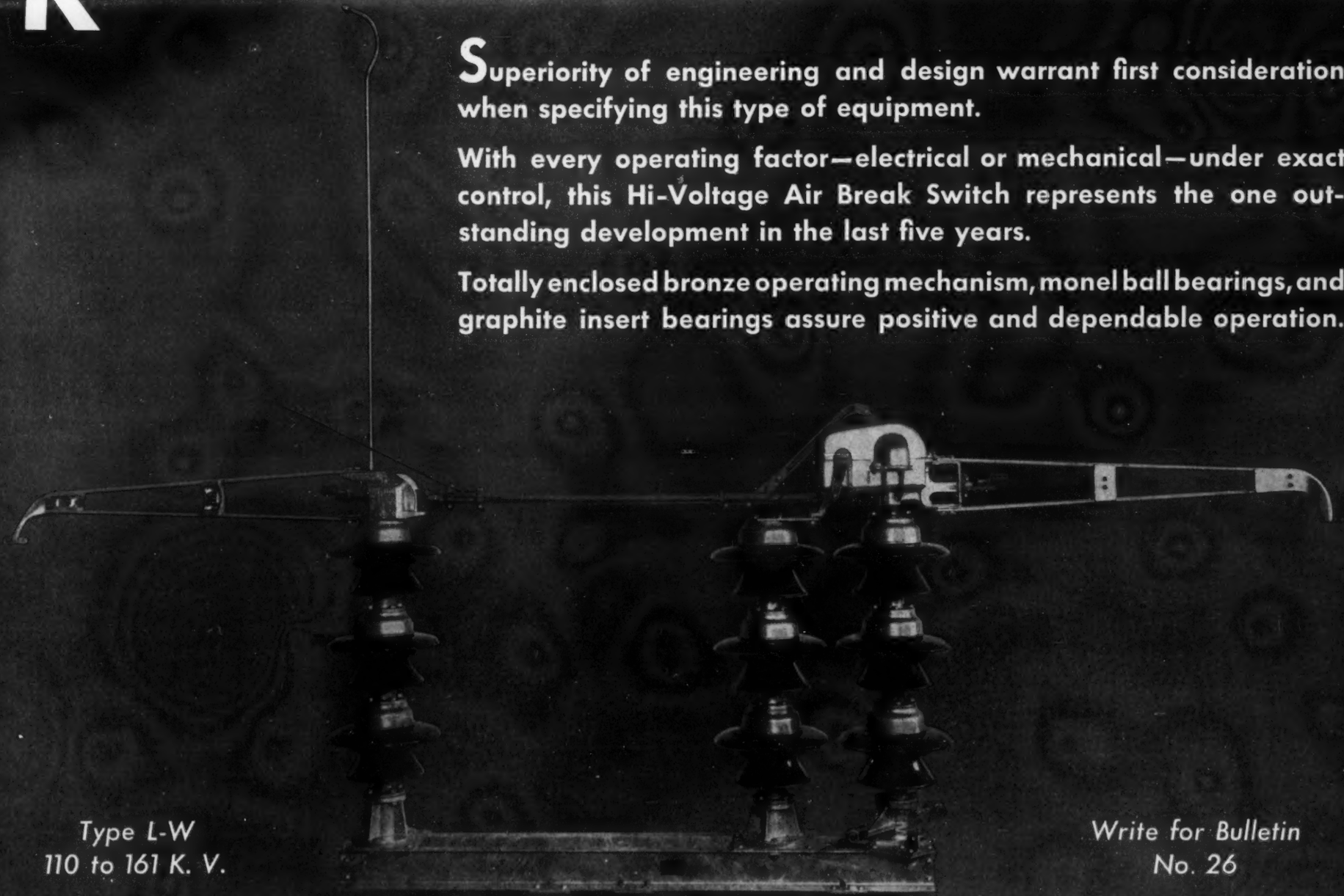
REVOLUTIONARY

REVOLUTIONARY

Superiority of engineering and design warrant first consideration when specifying this type of equipment.

With every operating factor—electrical or mechanical—under exact control, this Hi-Voltage Air Break Switch represents the one outstanding development in the last five years.

Totally enclosed bronze operating mechanism, monel ball bearings, and graphite insert bearings assure positive and dependable operation.



Type L-W
110 to 161 K. V.

Write for Bulletin
No. 26

HI-VOLTAGE EQUIPMENT CO.

2891 EAST 79TH ST.
CLEVELAND, OHIO

was chairman of the British Daylight Committee, which visited the United States in connection with the International Illumination Congress in 1928.

•

Moody to Manage Northwestern District

A. S. Moody is now manager of the northwestern district of the General Electric Company, consisting of Oregon, Washington and a portion of Idaho. The company recently divided the Pa-

cific Coast region into two separate areas. R. M. ALVORD is manager of the newly formed Pacific district, which consists of California, Arizona and the western portion of Nevada. J. A. CRANSTON, Pacific Coast vice-president, continues in executive charge of both districts, with headquarters in San Francisco. Both of the new district managers have been active in the electric industry on the Pacific Coast for many years.

•

▶ JAMES R. COXE, general superintendent of transportation for the Consolidated Edison Company since 1929, has been given additional duties as general superintendent of transportation for the New York Edison Company.

▶ J. MORTON DAVIS, production manager of the River Works of the General Electric Company, Lynn, Mass., has retired after 38 years service with the company. He is succeeded by Albert S. Murray, who has been with the company since 1910.

▶ A. J. SNOW, chief engineer, district "F," of the Salt Lake City office of the Board of Fire Underwriters of the Pacific, has recently been appointed to membership in the electrical council of Underwriters' Laboratories to fill the vacancy caused by the death of Claude W. Mitchell, formerly chief electrical engineer. Mr. Snow, who has been serving as assistant secretary of the Salt Lake office of the board, was received formally as a member of the council and participated in the meeting held June 16 and 17 at the New York offices of Underwriters' Laboratories, at which time problems relating to the safety of electrical equipment and installations in buildings were discussed.

▶ SAMUEL MARTIN, JR., has been appointed manager of the newly organized product division of the General Electric Company's air-conditioning department. Mr. Martin, a graduate of the University of Pennsylvania, has been with the company since 1925.

▶ DEAN HERMAN SCHNEIDER of the University of Cincinnati has been awarded the Lamme Medal for achievement in engineering education. Annually this award is made to a technical teacher for outstanding accomplishment in his profession or for actual advancement of the art of technical training. It was originated by Benjamin G. Lamme, late chief engineer of the Westinghouse company. Dean Schneider instituted the co-operation plan of education at the University of Cincinnati.

▶ NICHOLAS S. HILL, JR., of New York, president of the Hackensack Water Company, has been elected an honorary member of the American Water Works Association. Mr. Hill, an authority on utility valuation and rate making, was cited as "an engineer of unusual technical ability combined with business capacity." He is a member of the American Institute of Electrical Engineers.

▶ FRED STARRETT, who joined Portland General Electric Company in 1922, has been connected with the sales department

Fred Starrett

for the past ten years. He has recently been promoted to the position of supervisor of merchandise salesmen by the Portland General Electric Company.

▶ J. P. MCILHENNY, formerly manager of sales for the Elliott-Lewis Electrical Company, Philadelphia, has been appointed district manager of appliance sales, G. E. Supply Corporation.

▶ HARRY B. KIRKLAND, assistant to the managing director of the National Electrical Manufacturers Association, has been elected an honorary life member of the International Association of Electrical Inspectors. Men have been made honorary members before, but Mr. Kirkland is the only one so honored for life. This expression of appreciation is in recognition of many years of sympathetic interest in inspectors and inspectors' associations. Previous to his present position, Mr. Kirkland was director of the uniform legislation department of N.EM.A.

•

OBITUARY

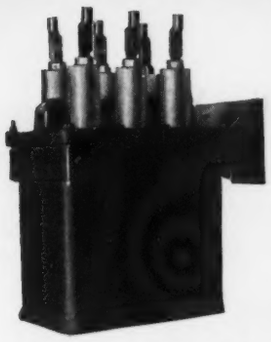
▶ WILLIAM H. CHILDS, general manager of the Hamilton (Ont.) Hydro-Electric System, died recently. When the proposal to bring Hydro power to Hamilton was first discussed Mr. Childs threw in his efforts in support of the cause. In 1910, when Hydro became a reality in Hamilton, he was appointed to the office of secretary of the local commission. In 1933 he was made general manager.

▶ ANTHELME BOUCHER, one of the pioneers of hydro-electric development in the French and Swiss Alps, died recently in Switzerland, at the age of 80.

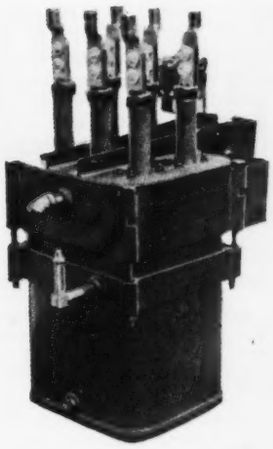
▶ WINFIELD S. JEWELL, a picturesque figure in the automobile industry and the reputed salesman of the first electrically driven motor car used in New York City, died in Littleton, N. H., July 1, following a heart attack. He was a graduate of Phillips Exeter Academy in the class of 1883.

▶ DR. EDWIN W. BULLOCK, safety engineer for many years of the Charles H. Tenney utility group and the New England Telephone & Telegraph Company, died suddenly at his home in Somerville, Mass. He had retired last spring. Dr. Bullock was a graduate of the Harvard Medical School and was one of the best-known figures in public utility accident prevention work in the Northeast.

▶ JOHN A. SIRNIT, designing engineer for the Alabama Power Company for 24 years, died in a Birmingham hospital June 30, following a month's illness. Before going to Birmingham in 1912 Mr. Sirnit was connected with the Westinghouse Electric & Manufacturing Company at East Pittsburgh. He was a native of Riga, Latvia, and came to the United States in 1906.

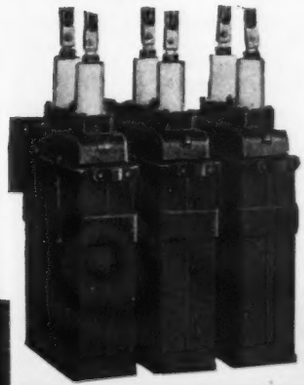


10,000 to 30,000 KVA interrupting range



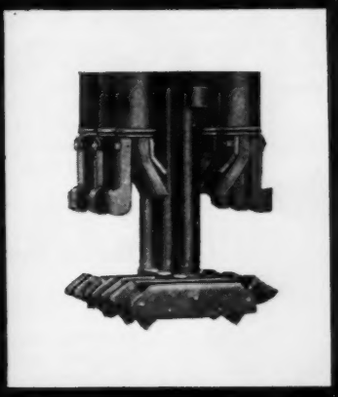
50,000 to 100,000 KVA interrupting range

100,000 to 250,000 KVA interrupting range



50,000 to 250,000 KVA interrupting range

Roller-Smith "TURBLATOR"



OIL CIRCUIT BREAKERS

THE Roller-Smith "Turblator" principle marked a real advance in the art of circuit interruption. Simple in construction, effective in operation and free from "gadgets" of all kinds the following features are outstanding.

- Reduction in arc length
- Quick quenching of arc
- Reduction in tank pressure
- Reduction in contact burning
- Increase in safety factors
- Reduction in breaker deterioration

All Roller-Smith Oil Circuit Breakers operate on the service-proved "Turblator" principle — which, with other notable Roller-Smith developments give these breakers "ALL THERE IS" in features.

A new catalog is available. Write for Catalog D-6.

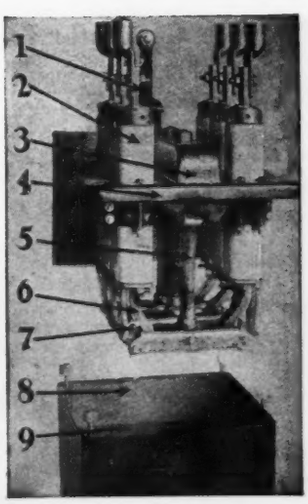
ROLLER-SMITH COMPANY

Electrical Measuring and Protective Apparatus

MAIN OFFICE
237 Broadway, NEW YORK

WORKS
Bethlehem, Pennsylvania

Sales Agencies in Principal Cities in United States and Canada



1. Continuous laminated copper from terminal to contact.
2. Rectangular wet process one-piece over-size porcelain bushings.
3. Internal straight line mechanism:
   (a) Protected from dirt and continuously lubricated.
   (b) No holes in top for oil throw.
   (c) Greater insulating distances.
   (d) Accurate metal to metal guiding — perfect contact.
   (e) No retardation or "blowing shut" of breaker due to internal pressure.
4. Heavy cast frame shaped and internally ribbed for strength. Double flange around tank seat to prevent oil throw.
5. Single piece contact rod.
6. Main contact an inverted brush accurately formed with positive separation of laminations for cooling.
7. Main and arcing contacts utilize electro-magnetic fields to increase brush pressure.
8. Heavy sheet steel welded tank with double thickness top, radius corners and large supporting lugs.
9. Insulation cell for each phase, isolating phases in tank. (Large oil and gas expansion space.)

NEW EQUIPMENT AVAILABLE

Battery Signal

Exide discharge indicator is an instrument for warning operators of electric industrial trucks when the battery should be removed and recharged. It is a small device which is mounted on the truck in sight of the operator. When the voltage drops to a pre-

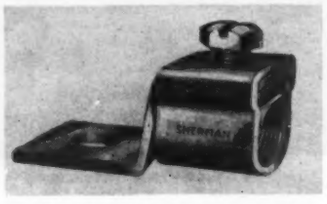
Electric Storage Battery Company, Philadelphia, Pa.

determined point a red bull's-eye flashes its warning signal to the operator. Operation of the indicator is simple. A relay is set to operate on a predetermined voltage (25 volts for a 15-cell battery). When the battery gets sufficiently low the relay trips and current flows to the signal lamp. Before placing the signal on the market a number of them were put into actual service on trucks and they proved satisfactory, it is said.

•

Solderless Lug

No special wrenches are required and no separation of wire strands is necessary in applying the new line of Sherman solderless lugs. In assembly the wire is under ample pressure to prevent heating. The lug is of one-piece design and is one-third as heavy



For wire sizes from No. 8 stranded or No. 7 solid up to 500,000 circ.mil. **H. B. Sherman Manufacturing Co.,** Battle Creek, Mich.

but twice as strong as a cast lug. It is interchangeable with standard lugs as it is of such flexible design as to be readily adaptable to special applications.

•

Recycling Timer

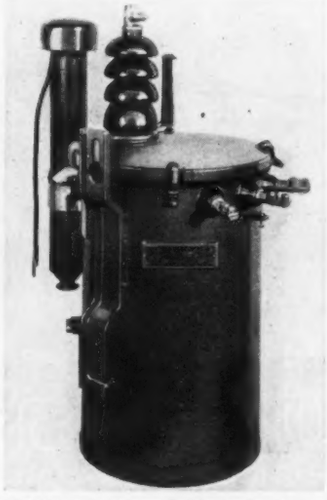
Struthers Dunn Co., Philadelphia, Pa.

A motor-operated timing device of the immediate recycling type is newly announced. A synchronous motor in this unit drives cams through a chain of gears. When the starting impulse is received, the motor starts and a solenoid is energized to operate a clutch, which in turn connects the cams to the motor. At the end of the cycle the motor is de-energized by a contact on one of the cams. The clutch holds the cams in position. When the solenoid is de-energized cams are returned to the starting position by a spring. Timing is adjustable over a wide range and practically any desired arrangement of load contacts may be had.

•

Rural Service Transformers

Exceptionally low copper loss and low inherent reactance are features of a new line of rural service transformers offered by this company supplementary to the regular line of distribution type units. The high- and low-voltage coils are wound separately and are of circular design. The high-voltage winding is wound on a sectionalized spool and can easily be slipped off of the helical low-voltage winding. These transformers can be provided with arrangements for directly



Available in sizes of 1½ to 10 kva. at standard voltages. **Allis-Chalmers Manufacturing Company,** Milwaukee, Wis.

bolting to the pole or conventional hanger hooks can be supplied. They are made with either one or two primary bushings and include provisions for mounting surge diverters. All primary bushings are co-ordinated against surge conditions.

•

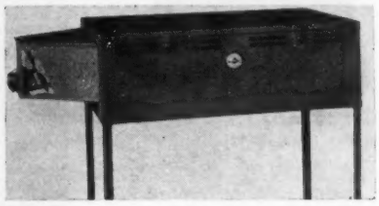
Portable Generator

Either a.c. or d.c. generators of ratings other than 1 kw. available. **Dale & Rankine, Inc.,** Newark, N. J.

A new generating unit has been recently introduced for supplying electric power to construction tools such as concrete vibrators, drills, saws, lights, etc., used in field locations where commercial power is not available. The unit consists of a 1-kw. d.c. generator driven by a 2.4-hp. 1,800-r.p.m., four-cycle, vertical single-cylinder gasoline engine mounted together on a portable carriage. Pneumatic tires are used on the carriage to reduce friction and vibration.

Blueprinting Machine

Essential features of older and smaller flat-bed model incandescent lamp blueprinters have been retained in this new unit, which is double the size of previous units. A timing switch of the heavy-duty type has been developed for automatically breaking the



Printing capacity, 24x36 in. **Milligan & Wright Co.,** Cleveland, Ohio.

heavier current. Forced ventilation is supplied to prevent tendencies to overheat. Economy of operation is claimed for both new and old models, which are said to produce prints at a cost of 1.3 cents per sq.ft.

•

Secondary Fuses

Sixteen sizes available ranging from 5 to 200 amp. **James R. Kearney Corp.,** St. Louis, Mo.

Isolation of service entrance faults, transformer secondary protection and, in general, greater assurance of service continuity are said to be possible with this new line of secondary fuses. They are completely self-contained units with a small cylindrical weatherproof cartridge of bakelite and an inner tube of fiber to give arc-extinguishing properties. On operation of the fuse a spring actuates, assuring separation of the line and giving visible indication of outage.

•

Low-Cost Relay

This new low-cost, a.c. relay is supplied for operation on voltages from 2 to 230 volts, 25 to 60 cycles. It can be furnished with as many as four pairs of contacts and has a capacity of 10 amp. per contact. It is of

G-M Laboratories Inc., Chicago, Ill.

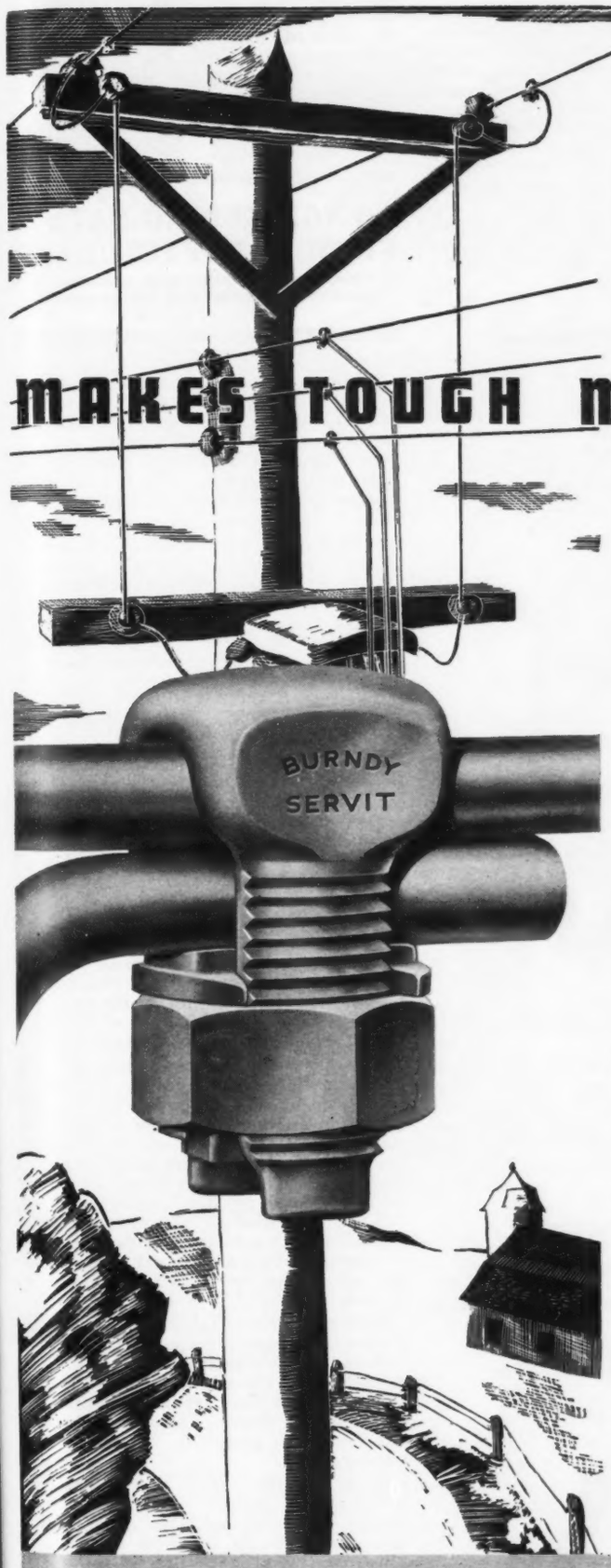
very simple construction, yet at the same time providing quiet operation. The coil is wound on a molded bakelite bobbin. It is designated as type A relay.

•

Truckair Compressor

Sullivan Machinery Co., Michigan City, Ind.

A new compressor unit designed specifically for truck mounting with power take-off from the truck propeller shaft to utilize the truck engine for drive has been announced. The compressor is two-stage air-cooled with capacity of 105 c.f.m. delivered



Forging

MAKES TOUGH METALS TOUGHER

The use of hardened copper for implements was known to the Egyptians as early as 3000 B. C.; the American Indian used this metal for arrow heads hundreds of years before the arrival of Columbus. For years it was mistakenly believed that the hardness of these implements was due to some forgotten art in metallurgy, but we now know that this hardness was acquired entirely by pounding the metal. This crude process was the forerunner of modern forging. Today, a machine can, in a few blows, accomplish what would formerly have required days of hand labor. Through the help of the metallurgist, better alloys are now available — alloys that, when forged, have greatly increased strength with decreased bulk.

THE SERVIT IS FORGED

By a patented process, Burndy forges the SERVIT, a connector of maximum strength and minimum bulk. It resists the highest possible wrench torque. Sharp edges are eliminated as no cutting operations are employed except on the nut. SERVITS made of high tensile Durium alloy are used for copper conductors, and Duralumin for aluminum cables. *Forged* SERVITS are *strong, re-usable, corrosion resistant, uniform, less bulky, efficient.* Get the advantages of the *forged* service connector; specify Burndy.

BURNDY

ENGINEERING COMPANY · 305 E. 45th ST. · NEW YORK CITY

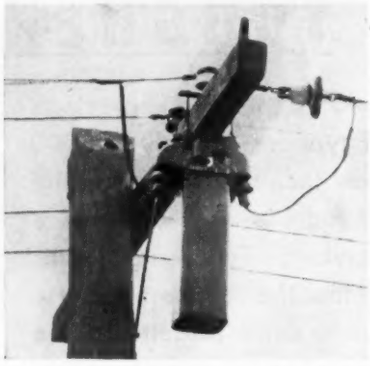
REPRESENTATIVES IN PRINCIPAL CITIES

—enough to operate a large rock drill or two pavement breakers. Features stressed are force feed lubrication, anti-friction main bearings, automatic control and small space requirements so that major part of truck space can be utilized to carry men, tools and materials.

•

Oil Circuit Recloser

Meeting the demand for an automatic oil circuit recloser with a lower current trip value, particularly for suburban branch and rural distribution circuits, the General Electric Company has announced the addition of an 8-amp. size in its line of Type FP-19 reclosers. Its weight, dimensions and accessories are identical to those of the 25- and 50-amp. units, the principal changes being



7,500 volts, 50 amp. **General Electric Company**, Schenectady, N. Y.

the necessary modification of plunger and magnetic structure to make it suitable for the lower current and the use of a greater number of turns in the series coil. The new recloser is rated 8 amp. continuous current, 30 amp. minimum tripping current and 250 amp. interrupting rating.

•

Cutting and Stamping Machine

Known as "Flexopress," this new cutting and stamping machine has two important applications in the electrical manufacturing industry. The first of these is the high-speed, automatic cutting of production materials to uniform length up to 9 in. Such

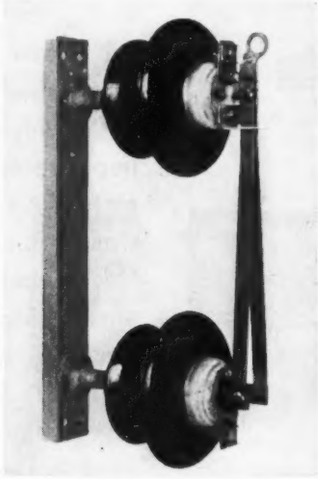
Model 400, "Flexopress." **The Paykes Company**, Chicago, Ill.

materials as wire, insulation, spaghetti tubing, tape, cloth, paper and light metal can be cut off at speeds up to 18,000 pieces per hour. The second important application is the stamping of small, light parts such as clips, connectors, lugs, spacers, etc. The dies are very simple, and this permits low cost. An interesting feature of the machine is the built-in automatic feed. This is equipped with an automatic locking device, insuring that pieces are all uniform length. There is also an adjustable, automatic release to permit stock alignment when using progressive dies. Since the operation of the machine is entirely automatic, it requires little attention, and one operator can easily handle a battery of several machines. Flexopress is furnished complete with stand, ½-hp. motor and four-speed drive, giving a speed range of from 6,000 to 18,000 strokes per hour.

•

Hook-Operated Switches

This new outdoor hook-operated disconnecting switch is single pole, includes a blade latch and is mounted on 3-in. bolt-circle standard N.E.M.A. outdoor insulators of the cemented cap and pin type. It is made in two types, FC-2 and FC-3, which are identical except that the FC-2 has switch parts mounted on the insulator caps for ver-



Rated at 7,500 to 34,500 volts, 200 amp. **General Electric Company**, Schenectady, N. Y.

tical mounting, while the FC-3 has switch parts on the insulator pins for underhung mountings. The blades of switches, rated 23,000 volts and above, are of rigid truss construction, making the switch easy to close and keeping the contacts in good alignment.

•

Lamp Base Extractor

Designed for removing the brass shell of broken electric lamps from the socket, this plier is equipped with spring action handles,

No. 107; length 6¼ in. **William Schollhorn Co.**, New Haven, Conn.

insulated with pliable rubber, as a safeguard against shock. The reverse acting jaws are of carbon steel, sharply pointed to grip the inside of the brass shell. It is used by maintenance and repair men of utility companies and industrial plants or where a quantity of electric lamps are used.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

TECHNICAL COATINGS—Useful information on surface coatings for the protection of steel structures against corrosion is given in a 10-page booklet of Technical Coatings, Inc., 11 Park Place, New York City. Recommendations for the application of these coatings to different industrial conditions are given.

RURAL ELECTRIFICATION MANUAL—Fifty-odd pages of pole-top layouts, each accompanied by a full bill of materials required, are in this bulletin, which summarizes the construction practices that have been satisfactorily used on farm lines for many years. Though not for heavy service, but for the lighter services, these drawings illustrate the most efficient combination of satisfactory service records and low cost. Copies are to be had from the Locke Insulator Corporation, Baltimore, Md.

DISTRIBUTION AND POWER TRANSFORMERS—General specifications and four pages of tabulated data on the losses, efficiencies, regulation, weight and dimensions of distribution and power transformers are in bulletin 500 of the Gardner Transformer Manufacturing Company, 4227 Hollis Street, Emeryville, Calif.

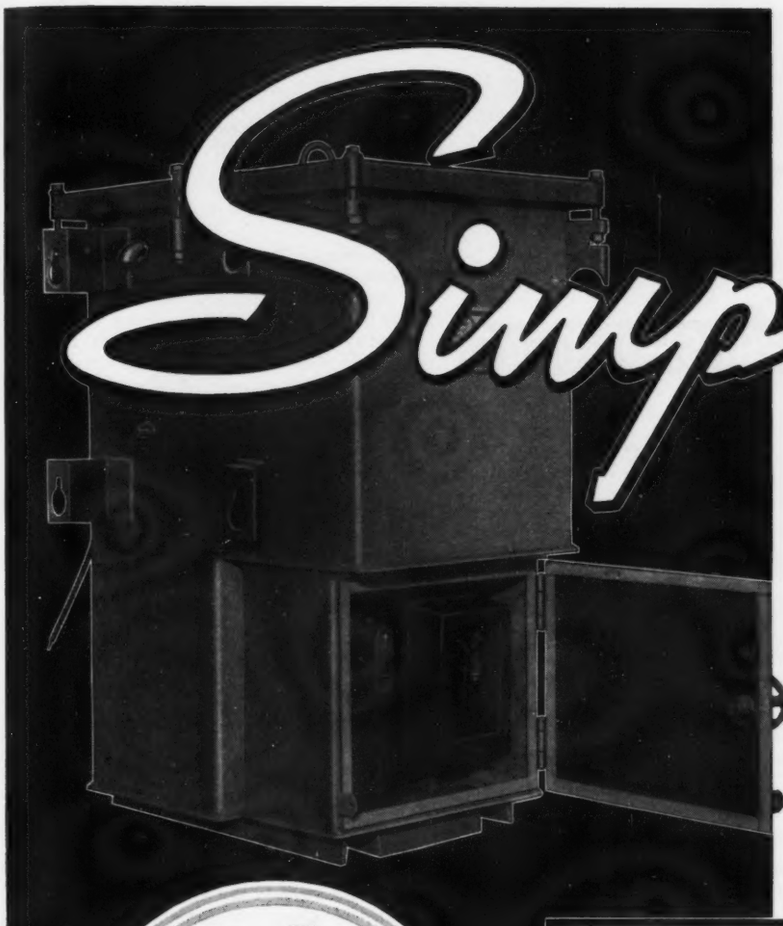
ALL-STEEL SWITCHBOARDS—Details of construction, dimension data, typical design layouts and connection diagrams and installation photographs of the "Multimite" type all-steel inclosed switchboards are in an attractive new pictorial booklet of the I-T-E Circuit Breaker Company, Philadelphia.

BASEBALL FIELD LIGHTING—Plans for baseball field lighting intended to assist club owners, contractors and utility lighting engineers in arriving at accurate estimates of the total cost of material and labor are in bulletin 2516 of the Crouse-Hinds Company, Syracuse, N. Y. They are based on similar jobs engineered by this company and are sufficiently detailed for any contractor who is familiar with pole-line construction. Bills of material include all material necessary for the job. Plans are for classes C and D leagues.

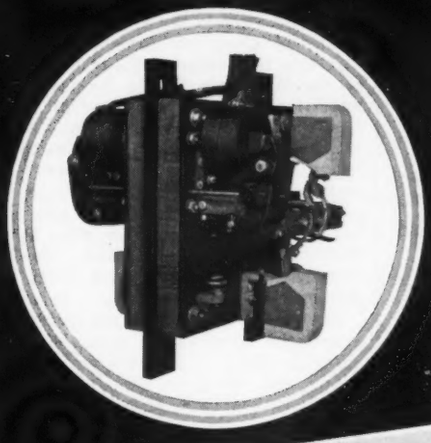
COPPER SHAPES—Tables of weights and dimensions of special copper shapes are in a bulletin of the American Metal Company. In addition to the tables, photomicrographs are included to show typical microstructure of the various shapes. Physical, mechanical and electrical properties of copper are tabulated.

SPEED REDUCERS—"Falk Speed Reducers" is the title of Bulletins 1100 and 2100 on parallel shaft and right-angle reducers, respectively, made by the Falk Corporation, Milwaukee, Wis. Each bulletin shows numerous applications of the various designs in the particular reducer type and gives instructions and data for the specification of reducers for all classes of service. An interesting feature of the bulletins is the inclusion of a section of small pictures and brief descriptions of the many gear products made by Falk.

Simplicity



THE KEYNOTE OF BR BOOSTERS



● There is nothing complex about Westinghouse BR Feeder-Voltage Boosters. Every part has been designed to attain the simplicity that reduces maintenance to the minimum and makes inspection as easy as possible.

In keeping with this spirit, simple magnetic-operated contactors are used for changing taps. No gears, motor, limit switches, or other similar devices are used. These contactors have both front and back contacts made of heat-resisting material to withstand all normal arcing and are submerged in oil to assure long life. To make them easily accessible for inspection and maintenance, they are mounted in a separate compartment at the top of the tank.

Ask for BR Booster Catalog 47-225, Room 5-N, East Pittsburgh, Penna.

J 70023

OTHER POINTS OF *Simplicity*

1 Control Box arranged for bolting to the booster tank, or for separate mounting away from the booster.

2 Control Panel with all relays can be removed easily from the weatherproof control box for laboratory adjustment.

3 Safety Switch for disconnecting control relays.

4 Time Delay in all positions to prevent needless operations.

5 Diagram Nameplate.

WESTINGHOUSE 1886 W 1936 GOLDEN JUBILEE

Westinghouse

DETAILS THAT MAKE WAGNER STUD-BUSHING-TYPE TRANSFORMERS SUPERIOR ARE:

Illustration of a 5 kva, 2400 to 120/240 volt, 60 cycle stud-bushing-type Wagner distribution transformer with a section of the tank wall cut away to reveal core and coils.

1. All coils are form-wound — thoroly dried and treated before assembling the core iron.
2. End-turns are extra-heavily insulated and definitely spaced to resist line disturbances.
3. Taps are brought out from the middle of windings where they do not interfere with the surge resisting design of the coils.
4. Core iron is built from non-aging silicon steel, specially manufactured for transformers.
5. Core iron laminations are cut with the grain of iron, the direction of which the magnetic flux encounters the least resistance.
6. All parts of the core and coils are completely immersed in transformer oil.
7. Tanks are formed of copper-bearing sheet-steel.
8. Tanks are electrically welded into an integral whole.
9. Tanks and covers are sandblasted outside and inside.
10. Every tank receives three coats of special transformer paint — selected for its adhesive and penetrating properties, its longevity, and its appearance.
11. Porcelain bushing flashover values coordinated with the transformer insulation strength.
12. Bushings are designed for easy removal without lowering transformer from pole or platform.
13. Tight-fitting bushings prevent syphoning of oil.
14. No solder is necessary for connecting transformers to line.
15. Transformers are shipped filled with oil, ready for service.

Write for Wagner Bulletin 180 which completely describes Wagner distribution transformers.

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, U.S.A.

TD336-1B

TRANSFORMERS MOTORS FANS BRAKES

Recent Rate Changes

COLUMBUS, DELAWARE, & MARION ELECTRIC COMPANY has announced voluntary reductions in electric rates to nine central Ohio communities, the principal of which is Marion. Marion's rate will range from 6½ cents to 1½ cents per kilowatt-hour, as compared with the recent range of 7 to 2½ cents.

LITCHFIELD LIGHT & POWER COMPANY has reduced rates in Ridgefield, Conn., by ½ cent per kilowatt-hour, which will net domestic users an aggregate saving of $19,000. A small reduction was also made in commercial rates.

NIAGARA, LOCKPORT & ONTARIO POWER COMPANY has amended two rate schedules, introducing initial charge form of block rate for residential service as the first step in a plan to eliminate socket count Wright demand form of rate for that class of service. Existing residential rates are retained as an option, restricted to customers taking service immediately preceding the date the new rates become effective. The territory affected is in Erie and Chautauqua counties.

GEORGIA POWER COMPANY has announced a reduction of rates for electricity in La Fayette, Ga., which will save customers about $3,300 during the first year. The rate reductions are especially beneficial to residential users.

COLUMBUS, WIS., municipal plant was ordered to reduce rates $2,970 by the state Public Service Commission recently on the ground that present schedules are discriminatory.

WISCONSIN PUBLIC SERVICE CORPORATION and MENOMINEE & MARINETTE LIGHT & TRACTION COMPANY have proposed voluntary rate reductions of $57,000. Reductions of the Wisconsin Public Service would be apportioned as follows: $40,000 a year to store and office users in the Wisconsin valley district, $7,800 to farm users in the valley and $2,500 to factory users in the eastern division.

LAGRANGE, GA., municipal power plant has been ordered to reduce rates by nearly $4,000 by the City Council. Residential consumers will benefit most from the reduction.

WISCONSIN GAS & ELECTRIC COMPANY has announced a voluntary reduction in rates affecting about 6,700 store and office users to go into effect on the July bills. The saving is expected to amount to $37,700 annually.

KEGONSA ELECTRIC LINE COMPANY has been ordered by the Wisconsin Public Service Commission to reduce rates by $830.

ILLINOIS NORTHERN UTILITIES COMPANY has been ordered to reduce rates by about $70,000. Commercial rates are affected.

SYRACUSE LIGHTING COMPANY has filed a revision of its residential electric rate with the Public Service Commission which adds a water heater clause to the rate applicable in District 10 of the company's territory. The water heating clause, effective July 6, provides that all energy in excess of 200 kw.-hr. monthly will be billed at 1½ cents per kilowatt-hour, when a consumer's hot water supply is solely derived from a permanently connected automatic hot water heater.

KENTUCKY-TENNESSEE POWER & LIGHT COMPANY has been ordered to reduce commercial and residential rates in Ridgely, Tiptonville and Dover. Reductions will amount to about 16 per cent and will be effective July 1.

UNION ELECTRIC COMPANY has offered new electric rates to the St. Louis, Mo.,

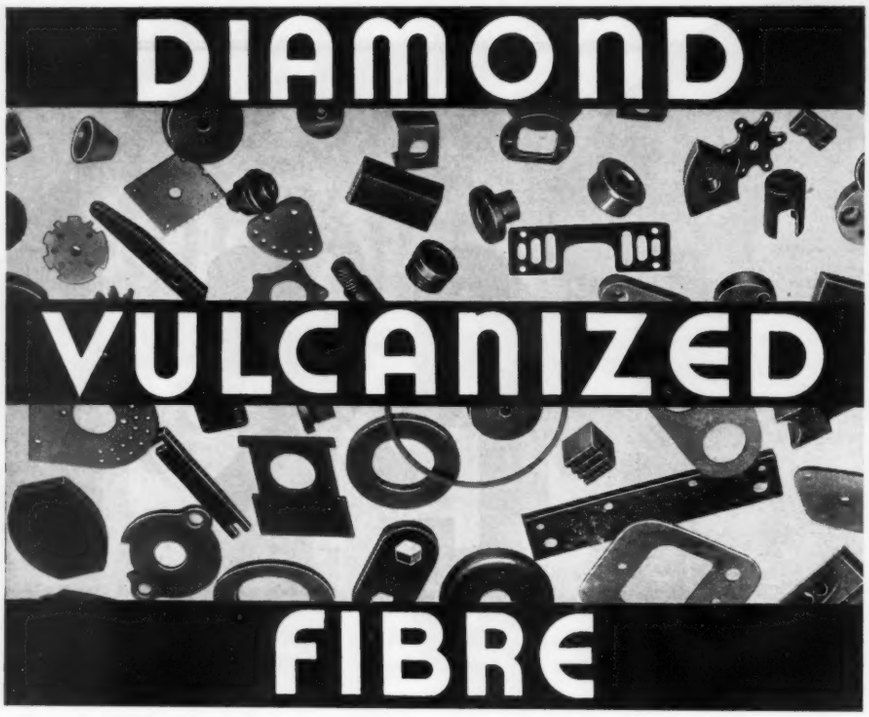
FACTS UNDERLIE FIGURES

● It may be significant that more than 430,000 miles of A. C. S. R. has been erected in the United States. And that over 70% of all transmission line mileage at 220 kv. or higher is A. C. S. R.

The real significance of these impressive figures lies in the actual savings which make such figures inevitable. Those savings are axiomatic. Longer spans, permitted by the better strength-weight ratio of A. C. S. R., slash costs. A. C. S. R. likewise cuts corona loss. Flash-over hazard is greatly reduced, because arcs on Aluminum are unstable and because the steel core furnishing 50-60% of the strength is always sheathed by the Aluminum strands.

To help you get maximum results and maximum economy from A. C. S. R., we furnish thorough engineering co-operation. The most recent evidence of this service is the development of a complete vibration dampening system, using Armor Rods and the Stockbridge damper. Feel free to make use of this service. There is no obligation. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

ALUMINUM COMPANY OF AMERICA



The Material of Countless Applications

Diamond Vulcanized Fibre—an insulating material—has good electrical qualities. It combines light weight with great mechanical strength and excellent machining qualities. It is a comparatively inexpensive material. It is widely used throughout all industry because it performs many duties more efficiently and more economically. It is made in standard sheets, rods and tubes and can be furnished in fabricated or formed parts to meet your specifications.

Learn about Diamond Vulcanized Fibre — the various grades developed for modern industrial purposes — methods of machining and fabricating. You'll find the complete story in our catalog. Write for a copy now if you do not have one.

CONTINENTAL-DIAMOND FIBRE COMPANY

Newark, Delaware

Board of Education for various grade schools and the new Southwest High School. Exact effect of the new rates has not been announced, but a substantial saving is anticipated.

NIAGARA, LOCKPORT & ONTARIO POWER COMPANY has filed revision of its primary power rate in the Batavia City Zone, which includes the city of Batavia, N. Y., and a portion of town immediately adjacent to the city in Genesee County. The change, which becomes effective July 5, revises the primary power rate in the demand determination of the rate by changing the demand determination from a five-minute determination to one of fifteen minutes' duration. The revised rate is made applicable to a 60-cycle service in addition to the present 25-cycle service to prepare for a coming change in frequency.

MOHAWK, N. Y., municipal plant has filed a revision of its rates which will save consumers an estimated $2,300 annually. The new rate schedules make general reductions in rates and change the present general rate structure to separate residential and commercial rates. No consumers will have increased bills as a result of the new rates, and residential users will save $1,850 of the total saving.

NEW YORK STATE ELECTRIC & GAS CORPORATION has filed revision of its rates applicable in the Dix and Reading districts. The change is to be effective July 15 and will result in a saving of about $50 to residential customers. The revision involves a lower residential rate with a water heating provision.

•

Municipal Plants

COLUMBIA, TENN.—The City Council has adopted a resolution asking the county election commission to call a special election August 1 to vote on a proposed $300,000 bond issue for construction of a municipal distribution system to be supplied by T.V.A. power.

JACKSON, TENN.—Application has been made for a P.W.A. loan of $575,000 to build an electric distribution system connected with the T.V.A. substation at that place. Under the P.W.A. agreement the city would be given an outright grant of 45 per cent of the fund and the remainder would have to be provided for by bonds. Citizens will be permitted to vote on the issue before the grant is made.

SOMERSET, KY.—No contract for construction of a municipal light and power plant in Middlesboro can be negotiated before a vote of the people in a regular general election. The city made arrangements in August, 1935, to finance construction of the plant, but court injunctions secured by the Kentucky Utilities Company thwarted plans thus far.

DARLINGTON, WIS.—The Wisconsin Public Service Commission is not obligated to enter a minute and detailed cost finding in fixing the price at which a municipality may acquire a public utility, but can decide upon a fair going value which is just and reasonable, according to a pronouncement of the commission recently when it affirmed its April 27 order placing $40,000 as the price at which the city of Darlington may acquire the Commonwealth Telephone plant.

BELLEVUE, OHIO — The Ohio Supreme Court has been asked by the city solicitor to force the Council of Bellevue to authorize a referendum on an ordinance calling for a survey of the cost of a municipal plant. The motion cannot be heard by the court until next autumn.

HOW IS YOUR *Piping?*

CRANE
600-Pound Cast Steel Flanged Fittings
309
WORKING PRESSURE
600 pounds, 900° F.
For working pressures at other temperatures, see page 301.
No. 845 D 90° Elbow
No. 846 D 45° Elbow
No. 847 D Tee
No. 859 D Cross

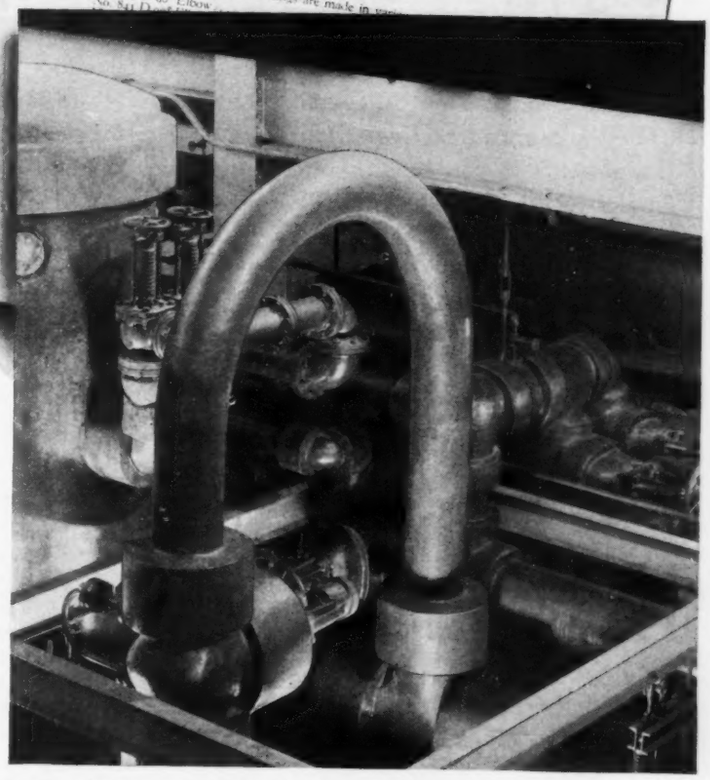
INCREASING demands for steam and the use of standby equipment in regular service have placed added responsibility on all types of central-station piping and have made more imperative the maintenance of its tightness.

Crane valves, fittings and fabricated piping insure tight joints because they are accurate—absolutely true to dimensions and to shape. They are precision-made and, where required, precision-finished.

You can reduce piping maintenance to a negligible amount on existing systems by replacing troublesome valves and fittings with Crane products. At the same time, you relieve strains upon the system as a whole. Assemblies which have to be taken apart at intervals, come apart readily and can be quickly remade with the same Crane fittings into tight assemblies.

When adding more steaming capacity or auxiliaries of any kind, eliminate heavy maintenance costs by making your piping tight and free from strain initially with Crane valves, fittings and fabricated piping. They are made in all sizes and all types for all purposes. The Crane branch or distributor in your city can serve you.

Let Profits Pay for Plant Improvements. Use the Crane Finance Plan.



• Crane Cast-Steel Fittings in boiler feed-water installation. Complete data and dimensions, arranged by pressure ratings, on pages 297 to 319, New Crane No. 52 Catalog.

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO, ILLINOIS • NEW YORK: 23 W. 44TH STREET

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

Prints are gone forever!

Blue prints have never made satisfactory reproductions. They are hard to read and to check. Detail is likely to be confused. They are not attractive. *And now you no longer have to use them*—for, if you have a blue print machine, you can easily make BLACK AND WHITE reproductions.

Bruning Black and White prints are produced in much shorter time than blue prints. The paper is exposed in your blue print machine—then instantaneously developed in the BW Developing machine. You say goodbye to washing and drying of prints—for BW prints eliminate these steps. And remember, BW prints are not only easier to read, but with their white backgrounds, they are far easier to check and make notes on. Get the whole story of the Bruning BW process! Mail coupon today.

BRUNING *Since 1897*

BW PRINT

Charles Bruning Co., Inc.
102 Reade Street, New York, N.Y.
Gentlemen: Please send me your
FREE illustrated booklet, "Prints for Today."

Name .....
Company .....
Address .....
City ..... *State*..... 680

The opening of the new Bruning branch at Kansas City, Mo. (formerly the Gallup Map and Supply Co.)—augments Bruning's nation-wide facilities for service—and is additional evidence that Bruning leads the field today in sensitized papers, reproduction processes, drawing material and drafting room equipment.

NEW YORK CHICAGO DETROIT BOSTON NEWARK
ST. LOUIS PITTSBURGH LOS ANGELES SAN FRANCISCO
MILWAUKEE KANSAS CITY

EAST LIVERPOOL, OHIO—Mayor O. Earl Greenawalt has been advised that the P.W.A. has approved the city's revised application for a $675,000 grant for the construction of a municipal power plant, which is to cost $1,500,000.

MCPHERSON, KAN.—The Kansas Gas & Electric Company recently asked the Supreme Court of the District of Columbia to restrain P.W.A. from making a grant of $45,000 to the city of McPherson for the construction of transmission lines in rural McPherson County and the town of Moundridge.

SAN ANTONIO, TEX.—Information has been received here from Washington that an allotment of $2,770,000 of Public Works Administration funds for the construction of a municipal electric light and power distributing system here has been technically approved by the power division of the administration. The final granting of the allotment is dependent upon the ability of San Antonio to obtain power from some outside power utility, it was stated. "The technical approval of the project does not mean that final action has been taken," it was explained by Clarke Foreman, director of the power division of the P.W.A., in a letter to Congressman Maury Maverick of San Antonio. "It merely means that, on examination, it has been approved from a technical point of view. No allotments out of the new appropriation have yet been made." The $2,770,000 represents only 45 per cent of the cost of the distribution system. On that basis, the cost would be $6,155,555. The city applied to the P.W.A. for $11,000,000 as a 45 per cent grant on power plant and distribution system. However, Foreman in his letter to Congressman Maverick says: "We felt that it would not be economically wise to grant money for a generating plant for San Antonio so close to the plants which we are helping on the Lower Colorado River."

HALLETTSVILLE, TEX.—Mayor J. G. Traxler has received bids for the purchase of $35,000 of 4 per cent municipal electric light and power plant bonds. Bonds are in denominations of $500 each, dated July 15, 1936, with option of redemption at the end of ten years from date. Consideration of the bids is now being given.

GAINESVILLE, TEX.—The City Council has called a special election for July to vote on the proposal to issue $230,000 of revenue bonds to be used in the construction of a municipal electric light and power plant. The proceeds from the sale of these bonds will be supplemented by a Public Works Administration grant of $188,000, making a total cost of $418,000. No tax will be levied to retire the revenue bonds, it was stated by Mayor Austin Reed.

•

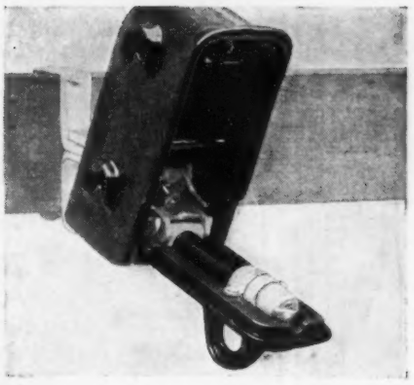
Electric Truck Sales Grow

Shipments of electric industrial trucks and tractors indicate a steady increase in the electrical handling of materials. According to figures announced by the Bureau of the Census, summarizing reports of 10 leading manufacturers, these shipments during the first five months of 1936 were 50 per cent above those for the like period in 1935—451 against 301. Of these totals 420 and 290, respectively, were within the United States, the remainder being for export.

May shipments were 91 units, compared with 67 a year ago, 63 two years ago and 112 in April, 1936.

Line Protection

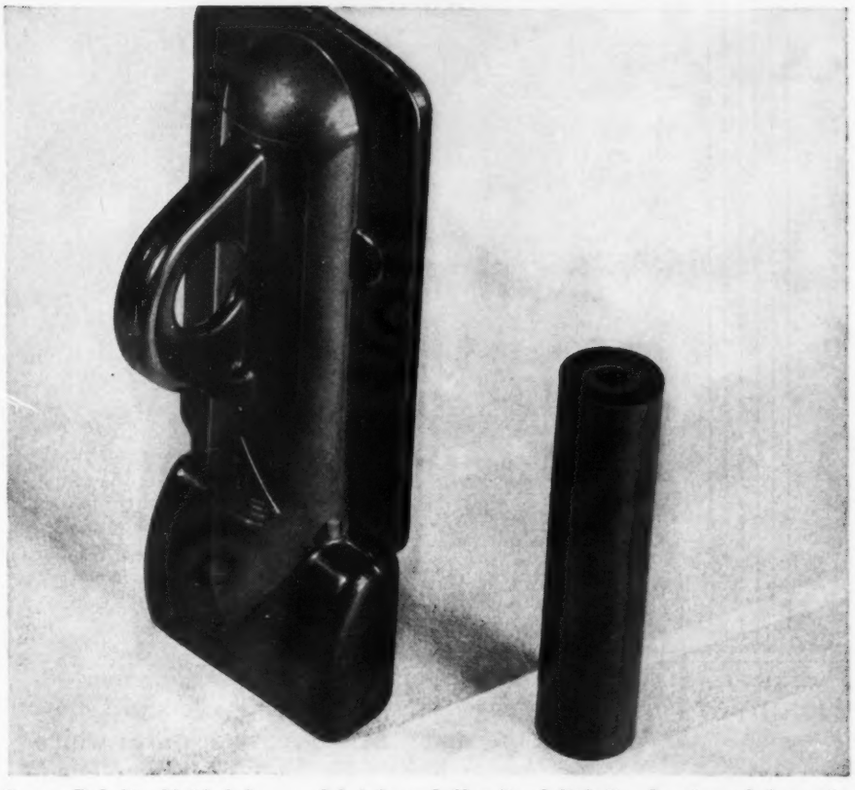
made "Doubly Sure"



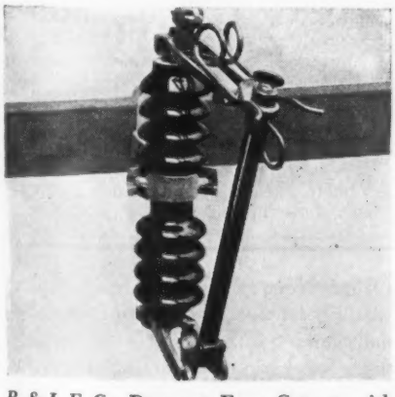
THE USE OF Bakelite Materials for two *key* parts of the expulsion fuse cutout pictured here, gives a double assurance of dependability. Safeguard No. 1 is the door with integral pull ring completely formed from Bakelite Molded. Safeguard No. 2 is the sturdy fuse tube of Bakelite Laminated.

The Bakelite Molded "dead-front" door provides the important advantages of safety to operators, sturdy insulated mounting of "live" parts, and all-weather durability. In the fuse tube, Bakelite Laminated furnishes the high mechanical strength, weather resistance and enduring dielectric strength essential to long service life.

Similarly, in many other devices and equipment parts now serving electric light and power companies, Bakelite Materials afford several outstanding advantages simultaneously. Characteristics that adapt them to almost unlimited usefulness include: mechanical strength and toughness, enduring dielectric strength and insulation value, and high resistance to moisture, temperature change, sunlight, oil and most chemicals.



Brown Bakelite Molded door and bright red fiber-lined Bakelite Laminated fuse tube used for the 5000-volt, 50 amp. Expulsion Fuse Cutout shown above. Product of Railway & Industrial Engineering Company, Greensburg, Pa.



R. & I. E. Co. Dropout Fuse Cutout with Bakelite Laminated fuse tube.

Bakelite Materials are available in a wide variety of forms and specifications to meet many different requirements. Engineers and designers are invited to call on us for information and cooperation in applying them. Also write for useful reference data in our illustrated booklets 3M, "Bakelite Molded", 3L, "Bakelite Laminated", and 3V, "Bakelite Varnish".

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.
BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario, Canada

BAKELITE

REGISTERED U.S. PAT. OFF.

The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products.

THE MATERIAL OF A THOUSAND USES

If you want Modern Transformers see what AmerTran offers . . .

AmerTran Distribution Transformer, 450 Kva., three-phase, 33,000/16,500 volts to 2,400/4,160Y volts.

AMERTRAN PRODUCTS

Transformers:
- Power
- Distribution
- Instrument
- Air-cooled
- Testing
- Welding
- Audio frequency
- Plate supply
- Filament heating
- Special purpose

Voltage Regulators
Testing Sets
Spot Welders
Rectifiers

MAY we send you a copy of our new 40-page catalog No. 116? This will show you the many new quality features which are being built into one AmerTran Product—distribution transformers. It fully illustrates and describes constructional details of cores, coils, tanks, and bushings. All these parts have been improved, and equipment now available gives more value per dollar investment than ever before.

In addition to distribution transformers AmerTran has furnished many other types of transformer equipment to utility and industrial companies for more than a third century. Your inquiry concerning any of the products listed on the left will receive prompt attention.

AMERTRAN TRANSFORMERS

Manufactured Since 1901 by—

AMERICAN TRANSFORMER COMPANY

172 Emmet St. . . . . Newark, N. J.

Can Purchased Power Be Advertised?

[*Continued from page 38*]

impossible to bring them together for the concerted action that is necessary.

But the Petroleum Electric Power Club did not know that the job was impossible, so it just calmly went ahead and raised a few thousand dollars from the utilities represented in its membership and undertook an advertising program in oil industry magazines. Ask any member of the club (keep in mind that he is a power salesman, one of the boys who go out and get the contracts) whether or not this advertising is effective.

•

Norway and Canada Lead in Energy Use

Quoting from the Statistical Year Book of the League of Nations, except for Canada and the United States, the recently issued final report of the census of central electric stations in Canada for 1934 presents a table showing that Norway leads in per capita output of central stations, followed by Canada and Switzerland.

Data for various countries are given in the accompanying table.

Output of Central Electric Stations in Various Countries

Country	Total Output 1934 (Millions of Kw.-Hr.)	Population (Thousands)	Aver. Kw.-Hr. per Cap.
Canada	21,197	10,835	1,950
United States	84,930	126,425	670
U.S.S.R.	20,520	147,028	140
Germany	31,000	65,219	475
Belgium	4,023	8,092	497
Finland	1,846	3,463	533
France	15,300	41,229	371
Italy	11,884	41,177	289
Norway (1933)	7,250	2,814	2,576
Netherlands	2,158	7,936	272
Poland	2,650	32,133	825
United Kingdom*	20,690	44,795	462
Sweden	6,050	6,142	985
Switzerland (1933)	5,000	4,066	1,230
Czechoslovakia (1933)	2,613	14,730	177
Australia	2,716	6,730	404
Japan (1933)	18,160	64,067	284

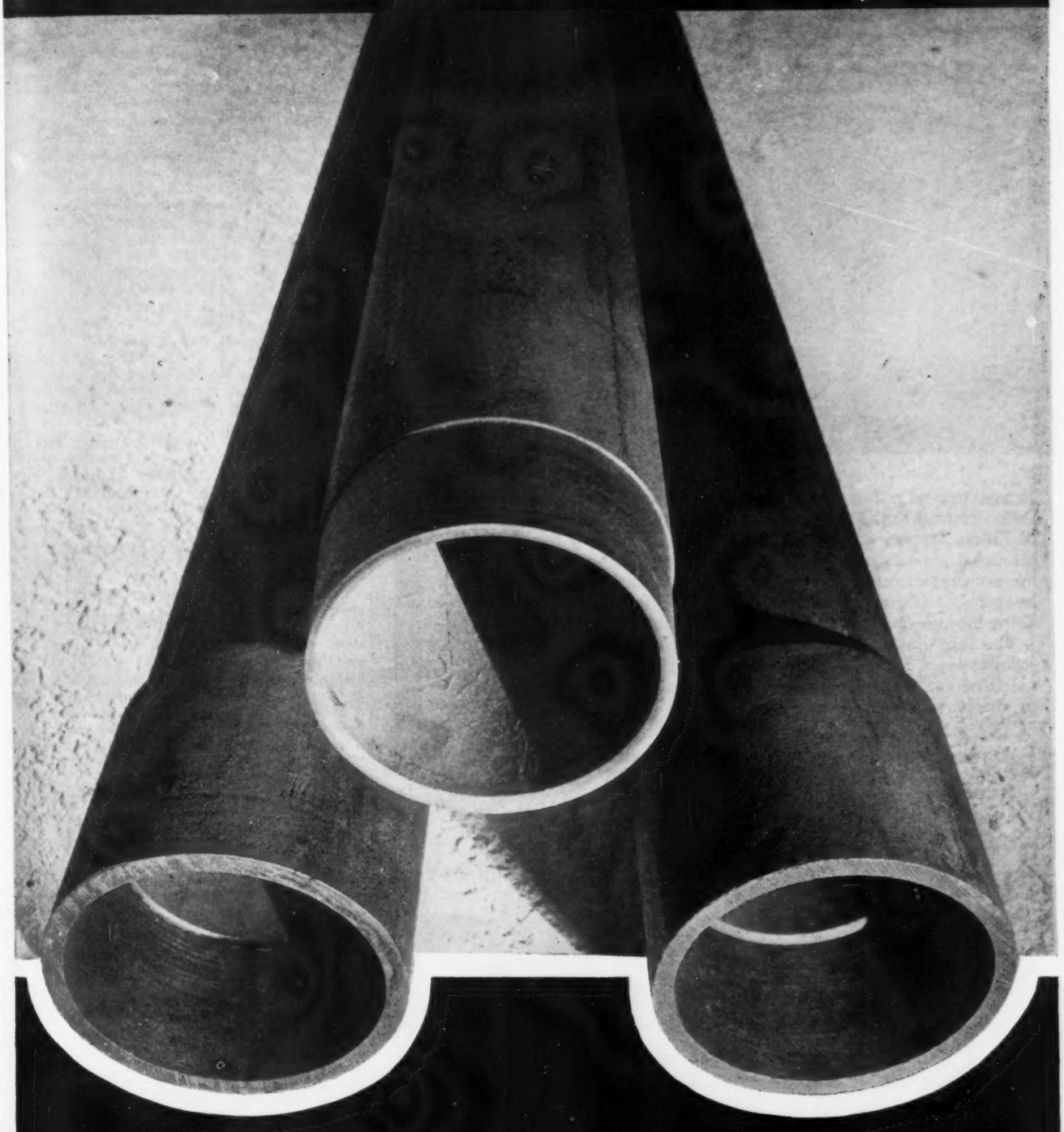
*Excludes North Ireland.

•

Canadians and Swiss Barter

Edmonton, Alberta, has evolved a novel plan to barter Canadian wheat for Swiss machinery to be used in extensions costing $500,000 to its municipal power plant. A Swiss company has tendered for the contract, and Joseph E. Clarke, Edmonton's mayor, has expressed his approbation of the idea.

ORANGEBURG FIBRE CONDUIT — *time-tested in 42 years' service*



Meeting every requirement for lasting and economical cable protection

. . lays up fast . . forms perfect joints . . aligns accurately

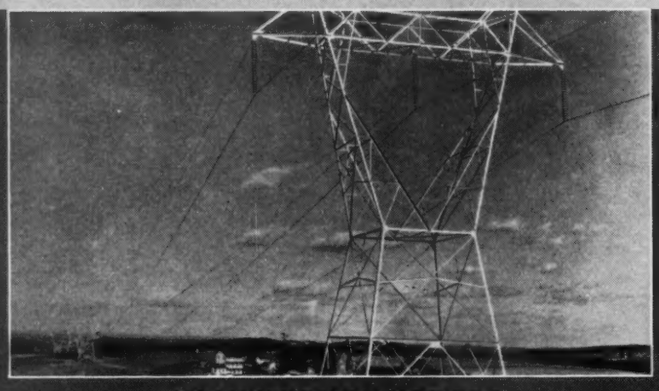
The Fibre Conduit Company • ORANGEBURG, N. Y.

SALES AGENTS:

G R A Y B A R ELECTRIC COMPANY

GENERAL ELECTRIC SUPPLY CORPORATION

BLAW-KNOX PRODUCTS
for
PUBLIC UTILITIES



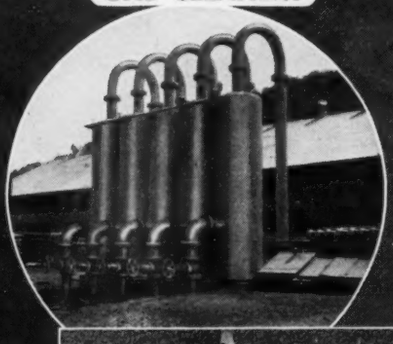
TRANSMISSION TOWERS

Thousands of miles of transmission towers . . . structural work necessitating highly specialized fabrication . . . enormous areas of Electroforged open flooring . . . standard steel buildings for all uses . . . gas cleaners for natural gas lines . . . steel forms for concrete tunnels, walls, etc. . . . steam purifiers, desuperheaters . . . clamshell buckets . . . and other products of Blaw-Knox manufacture are at work for the Public Utilities of America.

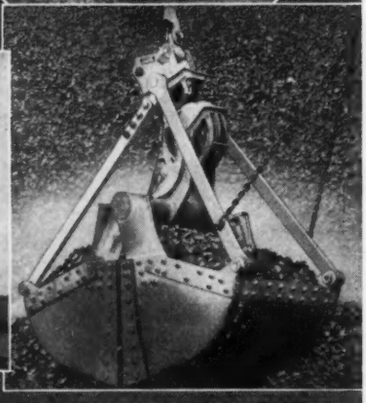
The fact that Blaw-Knox Products are in accord with the rigid standards of Public Utility purchasing is proof not only of the merit of the products themselves but of the house behind the products.

STEEL GRATING

GAS CLEANERS



STEEL BUILDINGS



CLAMSHELL BUCKETS

BLAW-KNOX COMPANY

2013 FARMERS BANK BUILDING, PITTSBURGH, PA.

SALES OPPORTUNITIES IN NEW CONSTRUCTION

KNOWLTON, WIS.—Wisconsin Valley Improvement Company, Wausau, Wis., has approved plans for water development and hydroelectric power project on Wisconsin River and tributaries near Knowlton, and will soon begin initial construction, comprising large water reservoir on Big Eau Pleine River. Following, a power dam will be built on Wisconsin River, where hydroelectric generating station will be situated. Project will include transmission lines, power substations and switching stations for power service in that area. Entire development will cost close to $15,000,000.

COLUMBIA, TENN.—Has called special election on August 1, to approve bonds for $300,000 for construction of municipal distributing system, including transmission line for connection with T.V.A. power lines and power substation units. Proposed to ask bids closely following. Freeland, Roberts & Company, Nashville, Tenn., are consulting engineers.

McKEESPORT, PA.—Firth-Sterling Steel Company plans installation of motors and controls, conveyors and other equipment in new addition to mill. Cost about $250,000.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until July 22 for electrical instruments for Boulder power plant, Boulder Canyon Project, Arizona-California-Nevada, including ammeters, wattmeters, portable watt-hour meters, portable voltmeter, automatic and laboratory type oscillographs, phase shifters, slide-wire type rheostats, etc.; also for sine-wave motor-generator sets, current transformers, laboratory-type switchboard, electric clocks and other equiment (Specification 813-D).

LIBERTY, MO.—Plans city-owned electric light and power plant. Engineer will be selected soon to prepare detailed plans. Cost about $140,000.

SMITHFIELD, N. C.—Johnston County Electric Membership Corporation, recently organized, has engaged Spoon & Lewis, Greensboro, N. C., consulting engineers, to make surveys and plans, and take bids for transmission and distributing lines in sections of Johnston and neighboring counties, totaling about 75 miles, with service facilities. Fund of $80,000 has been arranged through Federal aid. Carolina Power & Light Company will furnish power.

SOUTH CHICAGO, IND.—Carnegie-Illinois Steel Corporation, Carnegie Building, Pittsburgh, Pa., is having plans drawn by United Engineers & Constructors, Inc., 1401 Arch Street, Philadelphia, Pa., consulting engineer and contractor, for new steam-operated electric generating plant at works at South Chicago, to replace present mill power station and provide large increase in output. Installation will include three high-pressure boiler units and accessories, turbo-generators, three turbo-blowers, pumping units and auxiliary equipment, transformer station, etc. Facilities will be provided for additional equipment at later date. Cost about $5,000,000. Awards for equipment will be placed by engineer noted.

FLORENCE, ARIZ.—San Carlos Irrigation and Drainage District, Florence. C. H. Southworth, engineer, will hold special election early in fall to vote bonds for $300,000 for transmission and distributing lines for electrification of district in vicinity of Florence, Coolidge and Casa Grande, totaling about 110 miles.

KNOXVILLE, TENN. — Director of Purchases, Tennessee Valley Authority, Knoxville, receives bids until July 27 for hydraulic turbine units and accessories for power plant at Pickwick Landing.

NEWTON FALLS, OHIO—Takes bids soon

Are You Going After *Rural Electrification*?

BARE COPPER WIRES AND CABLES

COMPOSITE COPPERWELD-COPPER CONDUCTORS

WEATHERPROOF WIRES & CABLES—PEERLESS & URC TYPES

RURAL CABLES FOR DIRECT EARTH INSTALLATION

AERIAL CABLES

SERVICE DROP & ENTRANCE CABLES

GUARDIAN BUILDING WIRES & CABLES

ROMEX—NON-METALLIC SHEATHED CABLES

EVERY rural community in your district, not now being served by you, is a market of large potentialities.

General Cable's data books CRE-1 and RE-1 presenting characteristics and performance of transmission lines for rural electrification have been prepared to assist you in developing this highly desirable market.

A full line of wires and cables, all of General Cable quality manufacture, enables you to design and lay out rural installations with the assurance of profitable revenues from dependable service.

GENERAL CABLE CORPORATION

Sales Offices: ATLANTA · BOSTON · BUFFALO · CHICAGO · CLEVELAND · DALLAS · DETROIT · LOS ANGELES
NEW YORK · PHILADELPHIA · PITTSBURGH · ROME · SAN FRANCISCO · ST. LOUIS · SEATTLE · WASHINGTON, D. C.

WHERE service is to be made available to rural customers, the profitable operation of the line depends upon adequate permanence in construction and long term economy in maintenance. AmCreCo poles offer strength and durability—far above minimum specification requirements—which assures life exceeding amortization period with minimum maintenance and interruption costs. Let us quote on your requirements.

AMERICAN CREOSOTING COMPANY
INCORPORATED

COLONIAL CREOSOTING COMPANY INCORPORATED

AMCRECO

GEORGIA CREOSOTING COMPANY INCORPORATED

LOUISVILLE — KENTUCKY

for city-owned electric power plant and electrical distributing system. Cost about $160,000. Bryan & Sigmon, P. O. Box 111, Newton Falls, are consulting engineers.

SCRIBNER, NEB.—Elkhorn Valley Rural Power Company, Scribner, recently organized, plans transmission and distributing lines in parts of Cuming, Colfax and Dodge Counties for rural electrification, totaling over 100 miles, with service facilities. Fund of $132,000 has been secured through federal aid. Work scheduled to begin soon.

JACKSON, MICH.—Reynolds Spring Company plans installation of motors and controls, electric hoists, conveyors and other equipment in new addition to steel spring plant. Cost about $200,000.

FAYETTE, MISS.—Receives bids until July 21 for Diesel engine-generating set and auxiliary equipment for municipal station.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until July 24 for quantity of electric cable for Eastern and Western Navy Yards (Schedule 8371).

ITHACA, N. Y.—New York State Electric & Gas Corporation plans about 1,000 miles of transmission and distributing lines during 1936 for rural electrification in several counties, with service facilities for 4,000 additional rural consumers.

LAUREL, MISS.—Masonite Corporation, 111 West Washington Street, Chicago, Ill., plans installation of motors and controls, regulators, conveyors and other equipment in new addition to plastic board mill at Laurel. Cost about $125,000.

BUTTE, MONT.—Montana Power Company, Butte, is considering extensions in transmission lines in part of Blaine County, with distributing system for rural electrification.

INDIANAPOLIS, IND.—Board of Trustees, Indiana University, Bloomington, Ind., Thomas A. Cookson, secretary, receives bids until July 22 for turbo-generator set, condenser and auxiliary equipment for power station in new five-story and basement medical clinic building on West Michigan Street, Indianapolis. Robert F. Daggett, Medical Arts Building, and Charles R. Ammerman, Century Building, Indianapolis, are architect and mechanical engineer.

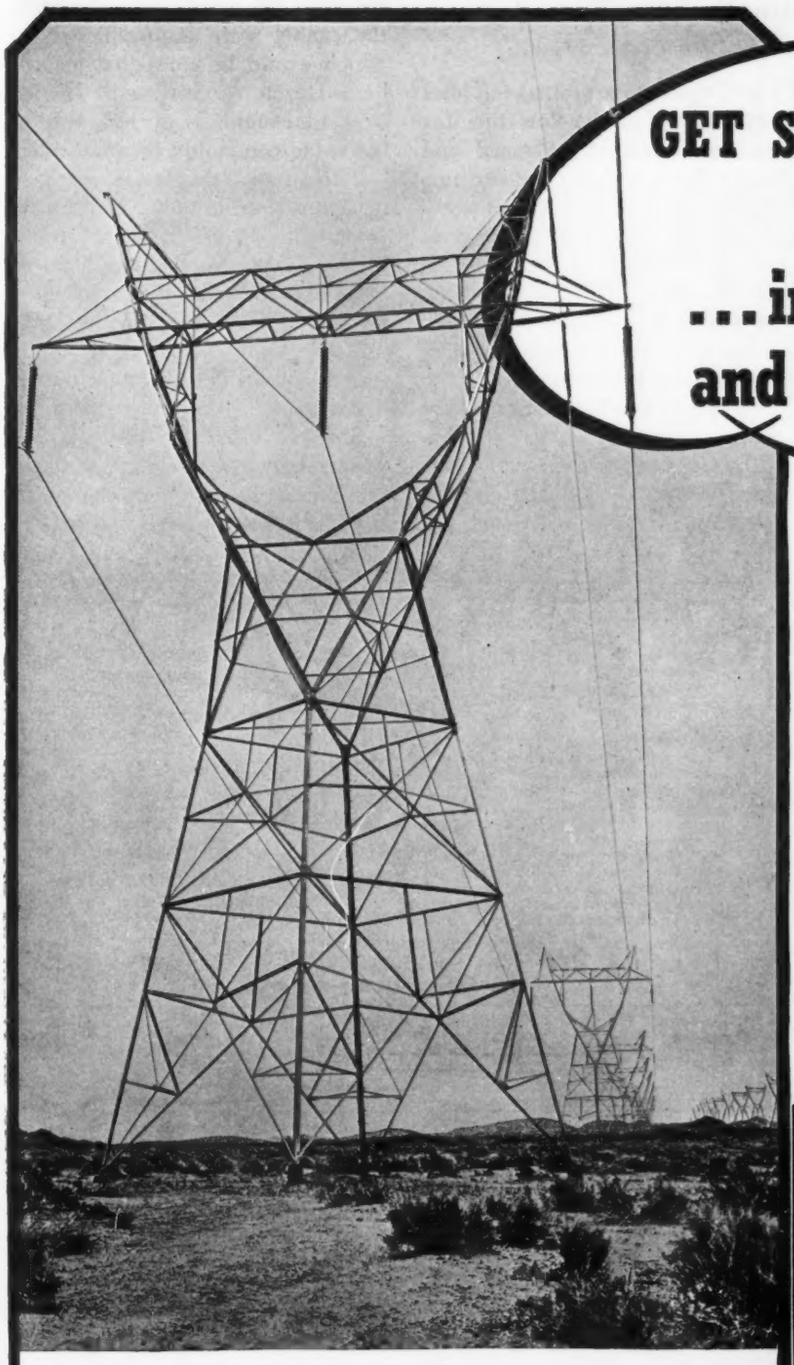
WASHINGTON, D. C.—United States Engineer Office, Navy Building, receives bids until July 21 for one gasoline engine-driven electric generating set (Circular 6).

FAYETTEVILLE, TENN.—Has engaged Lide & Adler, Birmingham, Ala., engineers, to make surveys and estimates of cost for municipal electrical distributing system, with power substation for service from TVA power lines.

SAN ANTONIO, TEX.—Plans city-owned electrical distributing system, including underground and overhead lines, transmission lines to different parts of municipality, power substations and service facilities. Fund of $2,770,000 is being secured through Federal aid.

LYNXVILLE, WIS.—United States Engineer Office, Commerce Building, St. Paul, Minn., and Clock Tower Building, Rock Island, Ill., takes bids in about sixty days for power, control and lighting system at Dam No. 9, Mississippi River, near Lynxville, to include dam power distribution system, lock and dam lighting system, navigation signal and lighting system, gas-electric standby power units, electric tow-haulage units and miscellaneous equipment. Later in fall, bids will be called for installation of similar system and facilities at Dam No. 3, Mississippi River, vicinity of Red Wing, Minn.

PHILADELPHIA, PA.—Commanding Officer, Ordnance Department, Frankford Arsenal, Philadelphia, receives bids until July 27 for quantity of 20-conductor rubber-insulated transmission cable (Circular 11).



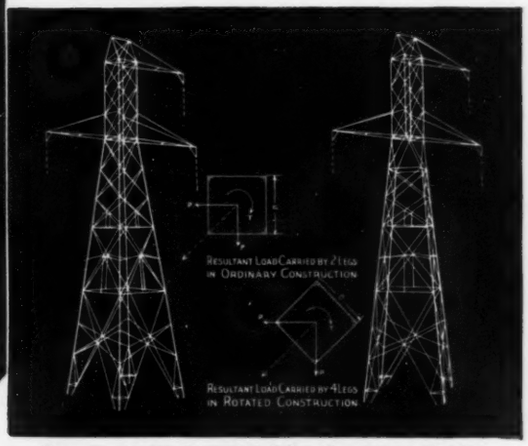
GET SAVINGS UP TO 30% ...in excavation and anchor steel

These 287,000 volt rotated towers are used by the Bureau of Power and Light, City of Los Angeles for their Boulder Canyon—Los Angeles lines across the Mojave Desert, a twin line about 250 miles long.

THE most severe loading of a tower due to a broken conductor together with a maximum transverse wind, is usually borne by two legs resulting in a pull at about a 45 degree diagonal.

Distribute this most severe loading evenly to all 4 legs by rotating the lower portion of the tower to this 45 degree angle, leaving the upper part in the regular position, and your savings in the cost of excavations and of anchor steel are considerable—as high as 30%.

This new development is the result of American Bridge experience in designing, fabricating and erecting thousands of towers for all kinds of uses. Call American Bridge Company technicians to assist in the study of your requirements.



Common type tower at left; American Bridge Rotated Type tower at right. On load plans transmission lines run vertically, maximum transverse wind horizontally, thus on common type tower 2 diagonally opposite legs carry resultant load. On American Bridge Rotated Type tower is seen distribution of resultant load to 4 legs, reducing greatly the maximum load on any 1 leg.

AMERICAN BRIDGE COMPANY
General Offices: Frick Building, Pittsburgh, Pennsylvania

Baltimore, Boston, Chicago, Cincinnati, Cleveland, Denver, Detroit, Duluth, Minneapolis, New York, Philadelphia, St. Louis . . . *Pacific Coast Distributors:* Columbia Steel Company, San Francisco . . . *Export Distributors:* United States Steel Products Company, New York.
Subsidiaries of the United States Steel Corporation

UNITED STATES STEEL

"FRAHM"
VIBRATING-REED
TACHOMETERS
AND
FREQUENCY METERS

Frahm Tachometer.

Portable Type Frahm Frequency Meter.

FRAHM Tachometers and Frequency Meters indicate by means of accurately "tuned" vibrating reeds. There are no pivots, jewels, rotating parts or pointers, and the instruments hold original calibration indefinitely.

Frahm Tachometers have been used for 25 years for indicating speeds of turbines, generators, motors, pumps, etc., running between 800 and 15,000 r.p.m. Numerous special applications. *Write for Bulletin 1390-W.*

Frahm Frequency Meters are made in both portable and switchboard types. They are wide in range and unaffected by wave form. *Write for Bulletin 1415-W.*

JAMES G. BIDDLE CO.
ELECTRICAL AND SCIENTIFIC INSTRUMENTS
1211-13 ARCH STREET. PHILADELPHIA, PA.

Other Biddle Specialties:—

"Megger" Insulation Testing Instruments
"Megger" Ground Tester
"Megger" Capacitance Meter
"Ducter" Low Resistance Testing Sets
"Dionic" Water Tester
"Jagabi" Rheostats
"Jagabi" Speed-Measuring Instruments

Hydraulic Loss Tests

[*Continued from page 53*]

In Fig. 7 have been plotted the total losses that occur in the flow line for different conditions of balanced and unbalanced flows between the two turbines. This figure is a working curve from which the water consumption of the turbines for normal plant operations is computed. The losses in each part of the flow line that had been determined from these tests were combined to produce this curve.

In general, it was found from these tests that:

1. The entrance losses were very small and varied about in proportion to the square of the velocity, and the losses in the concrete lined portion of the tunnel were approximately those which would be computed using Williams-Hazen formula with the coefficient of roughness of 134, this being the value commonly recommended.

2. However, the losses in the steel penstock were found to vary with the velocity to the 1.75 power instead of to the 1.852 power that is normally used in the Williams-Hazen formula. Consequently, it would be necessary to use a variable coefficient of roughness in the formula for this particular installation.

3. The losses in the wye branch were found to be relatively large and therefore worthy of more consideration than has been given them in the

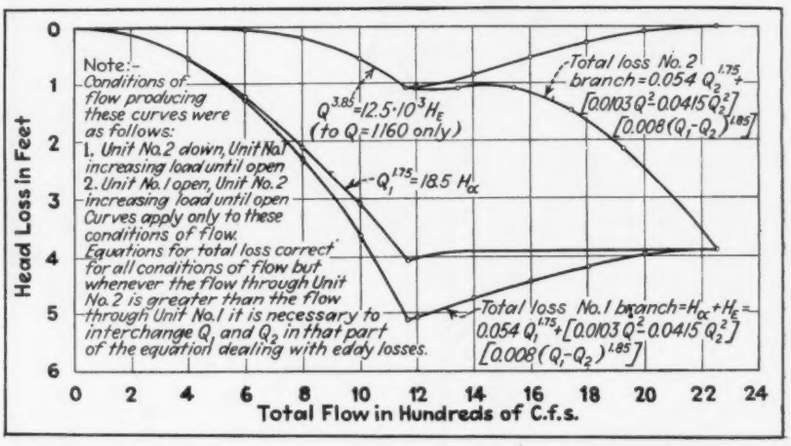

Head Loss in Feet
Total Flow in Hundreds of C.f.s.
Note:- Conditions of flow producing these curves were as follows:
1. Unit No.2 down, Unit No.1 increasing load until open
2. Unit No.1 open, Unit No.2 increasing load until open
Curves apply only to these conditions of flow.
Equations for total loss correct for all conditions of flow but whenever the flow through Unit No.2 is greater than the flow through Unit No.1 it is necessary to interchange Q_1 and Q_2 in that part of the equation dealing with eddy losses.
$Q^{3.85}=12.5\cdot10^3 H_E$ (to $Q=1160$ only)
$-Q_1^{1.75}=18.5\,H_\alpha$
Total loss No.2 branch $=0.054\,Q_2^{1.75}+[0.0103\,Q^2-0.0415\,Q_2^2][0.008(Q_1-Q_2)^{1.85}]$
Total loss No.1 branch $=H_\alpha+H_E=0.054\,Q_1^{1.75}+[0.0103\,Q^2-0.0415\,Q_2^2][0.008(Q_1-Q_2)^{1.85}]$

Fig. 6—Eddy and diversion losses in a wye branch of the penstock at the Chelan plant

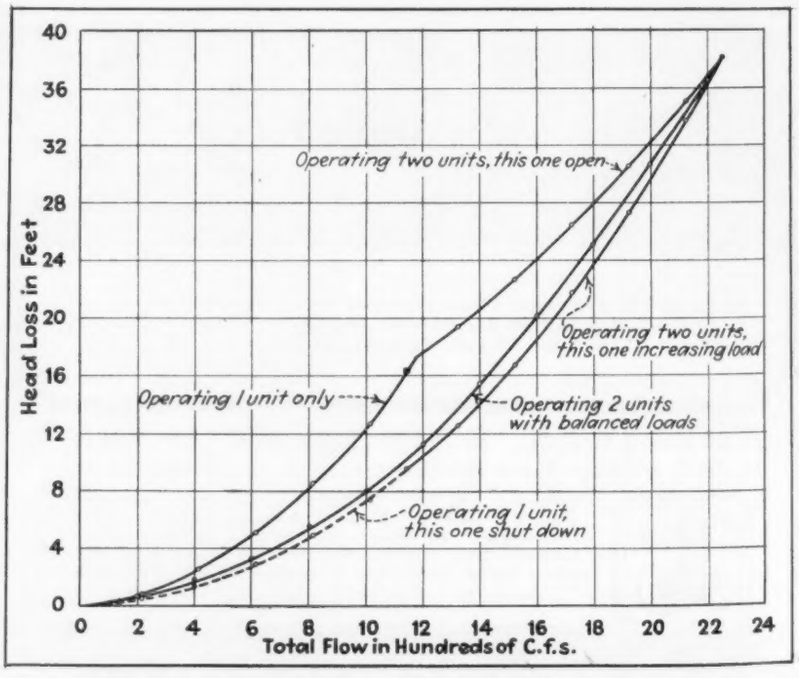
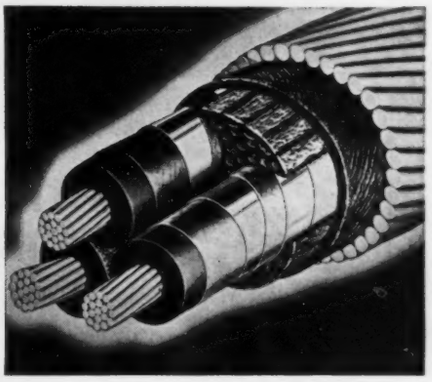

Head Loss in Feet
Total Flow in Hundreds of C.f.s.
Operating two units, this one open
Operating two units, this one increasing load
Operating 1 unit only
Operating 2 units with balanced loads
Operating 1 unit, this one shut down

Fig. 7—The working curve from which the turbine water rates can be computed. This shows the total over-all losses of head in the flow line between the forebay and scroll cases

Another Achievement

for Rubber Insulation



Leadless Submarine Cable operating at 33 K. V.

THE CABLE:

Three conductor # 4/0 Amarine Insulated non-leaded, jute and # 4 BWG Armor 3.9" O. D. weight 14.5 lbs. per foot

THE OPERATION:

4½ years at 22 K. V. now operating at 33 K. V.

THE CUSTOMER:

Connecticut Light and Power Company

THE MANUFACTURER:

American Steel & Wire Company

ELECTRICAL WIRES *and* CABLES

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

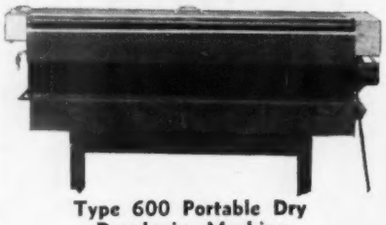
Empire State Building, New York

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Such Flexibility

has never before been known in ONE PROCESS



Type 600 Portable Dry Developing Machine

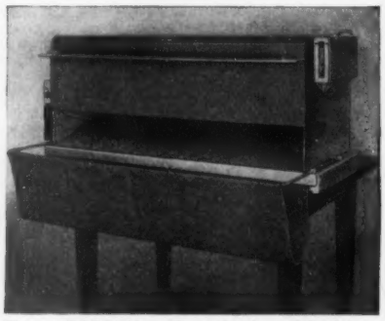
Ozalid WHITE PRINTS

Ozalid Dry Developing Equipment and Ozalid Sensitized Materials offer by far the most complete, flexible and economical technical reproduction system now available.

In two single steps—exposure and DRY development—you can make perfect modern WHITE prints, reproducing in blue, black, maroon or opaque sepia line as required. Unlike moist developing processes these prints can be made on thin tracing papers and opaque and transparent cloth in addition to all standard weight papers and cloths. This means that DUPLICATES can at last be made direct from original drawings without the use of Van Dykes, and with the duplicate retaining all of the detail and printing qualities of the original. Since no moisture touches the work there is no shrinkage.

Ozalid Dry Developing Machines include standard and portable types, also the new Ozalid-Wickes Combined Printer-Developer.

Explore the time-saving, money-saving possibilities of this new and better reproduction process. Just fill in and mail the coupon.



Type 2000 Dry Developing Machine

MAIL THIS COUPON TODAY

OZALID CORPORATION
354-356 Fourth Avenue, New York, N. Y.

Please send at once full details of OZALID MACHINES together with samples of prints and prices . . . all without obligation.

Name .....
Company .....
Address .....

past. They were composed of diversion losses and, in the case of unbalanced flows, eddy losses above the tie plate. It is probable that wye branches can be designed for greater hydraulic efficiency without sacrificing mechanical stability, and the author has been devoting considerable time toward that end. The diversion losses in the lower penstock bends were found to be large enough to warrant some consideration of the possibilities as to their reduction.

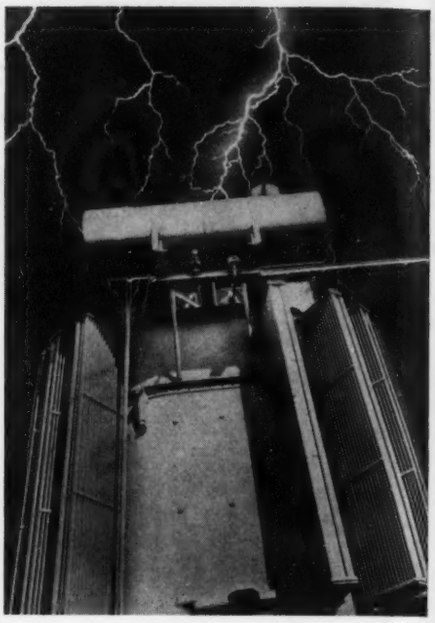
4. Total losses in the flow line from the forebay to either turbine scroll case were found to be approximately the same when the flows through the two units were balanced. However, when the flows were unbalanced the losses were found to increase over those present for corresponding balanced flows. This points to the possibility of greater operating efficiency through the balanced loading of the two units when the gain in efficiency is sufficient to offset the additional losses resulting from the use of two units instead of one.

•

Endowment Created by Rackham Trustees

Articles of incorporation of the Rackham Engineering Foundation were filed recently in the offices of the Michigan Corporation and Securities Commission by Standish Backus, Alex Dow, Edsel B. Ford, Bryson D. Horton and William S. Knudsen, who are trustees of the corporation appointed for life. The new corporation will have title to the $500,000 endowment created by the Horace H. Rackham and Mary A. Rackham fund for the benefit of the engineering professions and allied arts and sciences in the Detroit area, and for the assistance of the public in meeting engineering problems.

Under the plan adopted, the net income from the endowment will be paid to the Engineering Society of Detroit. The foundation will have a discretionary right to permit a portion of the endowment to be used to provide a permanent headquarters for the Engineering Society of Detroit. It will also have power to assign a portion of the income, not exceeding 25 per cent thereof per year, to pay the expenses of studying, investigating and exploring the practicability or wisdom of any proposed, contemplated or partially constructed public project in Detroit or vicinity involving engineering skill, judgment or knowledge, and of reporting to or advising any public body, commission or authority thereon.



Announcing a New Way to Forestall Transformer Faults

Device gives alarm for Minor Faults and Eliminates Major Faults.

Protection for transformers has in the past consisted of differential relays functioning to prevent system disturbances. It is now recognized that early detection of minor transformer faults will greatly reduce damages and often eliminate serious faults. The only device available for both prevention and protection of every type of fault on transformers is

THE KIDDE PROTECTOR

Based on the Buchholz principle universally used in Europe and adapted to American transformer design, the KIDDE PROTECTOR consists of two elements. One, a disconnect element operating to trip circuit breakers in case of major faults. The other a detection element that warns of minor faults at their inception while the disturbance is still too slight to be indicated by differential relay protection. Thus you are able to disconnect individual Transformer and avoid serious fault or shutdown.

Cost is now considerably less than relay protection.

Tear here — Send for your copy

Walter Kidde & Company, Inc.
69 West St., Bloomfield, N. J.

Kindly send me (without obligation) your new booklet describing the Kidde Protector.

Name .....
Position .....
Company .....
Address .....